SYSTEMATICS OF *MORAEA* (IRIDACEAE) IN TROPICAL AFRICA[1]

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ABSTRACT

Moraea, with 24 species, is well represented in tropical Africa, although the center for the genus is to the south in the winter rainfall region of southern Africa. Nine species are described for the first time. (*M. callista* Goldbl., *M. afro-orientale* Goldbl., *M. iringensis* Goldbl., *M. inyangani* Goldbl., *M. angolensis* Goldbl., *M. tanzanica* Goldbl., *M. upembana* Goldbl., *M. brevifolia* Goldbl., *M. balundana* Goldbl.) Only two of the five subgenera of *Moraea* occur in tropical Africa, subgenus *Vieusseuxia* and subgenus *Grandiflora,* the latter in particular exhibiting considerable radiation in south central Africa. On the basis of limited knowledge of morphological and cytological variation patterns in tropical Africa, *Moraea* is believed to be of recent origin here. Details of ecology, cytology, and evolution are elaborated and compared to patterns in southern Africa.

Moraea is a large genus of some 95 species, occurring throughout sub-Saharan Africa. The genus comprises small to medium-sized herbaceous geophytes. It is found mainly in highland areas in the tropics, usually in well-watered grassland, but also in open woodland or in marshy places. In temperate southern Africa, *Moraea* occurs at all elevations. *Moraea* is of some economic importance as all species are to some degree toxic to stock, section *Polyanthes* particularly so. Only a few species have been proven toxic, but all should be assumed to be until shown otherwise. The present revision treats only the tropical African members of the genus and will complete my taxonomic study of *Moraea,* begun in 1973 with a revision of *Moraea* in the summer rainfall region of southern Africa, followed by a revision of *Moraea* in the winter rainfall region of southern Africa (Goldblatt, 1973, 1976b).

This treatment includes as tropical Africa the area south of the Sahara and north of the region covered by the *Flora of Southern Africa* [Namibia (South West Africa), Botswana, Lesotho, Swaziland, and South Africa]. In this area, extending from Rhodesia north to Nigeria and Ethiopia, there are 24 species of *Moraea,* a larger number than previously recognized, but low in comparison to the 76 species in southern Africa. Only five species occur in both tropical and the southern African summer rainfall region, while one species, *M. spathulata,* occurs in the winter rainfall region of southern Africa as well. The present work is the first modern comprehensive treatment of *Moraea* in tropical Africa and the only treatment since Baker's (1898) revision for the *Flora of Tropical Africa.*

RELATIONSHIPS

The affinities and relationships of *Moraea* are discussed in detail in my revision of the species found in the winter rainfall region of southern Africa (Gold-

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blatt, 1976b) and also in a paper dealing with the cytology and subgeneric classification (Goldblatt, 1976a). In the latter paper I expanded my earlier hypothesis that *Moraea* is a relative of the widespread northern hemisphere *Iris* and that these two genera probably had a common origin from ancestors of the genus *Dietes*. *Moraea* is, however, more closely related to a group of South African corm-bearing genera which, like *Moraea*, also have a secondary bifacial leaf than to *Iris* or *Dietes*. These genera include *Homeria*, *Hexaglottis*, *Gynandriris*, *Galaxia*, and *Barnardiella* which are placed with *Moraea* in Homerinae (Goldblatt, 1976a), one of the three subtribes of Irideae, a predominantly Old World tribe of subfamily Iridoideae.

Geography of the Tropical African Species

Although *Moraea* occurs throughout sub-Saharan Africa, its present center is clearly the winter rainfall region of southern Africa which extends along the south and west coast of the Cape Province. Not only is this area richest with 54 species, 48 being endemic, but it is also the center of diversity in the genus. All five subgenera occur here and three of these are essentially endemic. The two largest subgenera *Vieusseuxia* and *Grandiflora*, also considered the more advanced, extend well outside the winter rainfall region. In fact, the center for subgenus *Grandiflora* lies outside this area, in the mountains of southeast Africa, extending from Natal to Malawi, Tanzania, and Zaïre.

Subgenus *Vieusseuxia*, the second subgenus found in tropical Africa, comprises two sections. Section *Polyanthes*, the less specialized, occurs from the southern Cape to Ethiopia and is well represented in Tanzania, as well as in the South African provinces of Natal and the Cape. The most primitive members of section *Polyanthes* are believed to be those with several leaves and unlimited branching, rather than single-leafed, few- or unbranched species; these include *M. polyanthos* and *M. polystachya* from the Cape Province and *M. carsonii* from Rhodesia-Zambia-Malawi. The center for this section thus may also lie in the mountains of southeast Africa but perhaps more likely to the south along the interface between the summer and winter rainfall regions. The second section of subgenus *Vieusseuxia*, section *Vieusseuxia*, is clearly specialized (Goldblatt, 1976b) and does not occur outside southern Africa where it is concentrated in the winter rainfall region.

In tropical Africa, *Moraea* occurs in almost all highland areas above 1,200 m and concentrations of species are found mainly in isolated areas that are considerably higher. Representation of the genus is notably poorer north of the equator with only two species in Ethiopia, three in the Uganda-Sudan-Kenya highlands, and only one in the mountains of eastern Nigeria and Cameroons. Significant areas of concentration are all in the highlands of central tropical Africa and several endemics occur in these isolated, and well-watered montane and semimontane regions. The main centers of endemism are as follows:

1. Inyanga highlands of Rhodesia: 5 species, one endemic (*M. inyangani*).
2. Northern Malawi-eastern Zambia escarpment and Southern Highlands of Tanzania: 8 species, 3 endemic (*M. tanzanica*, *M. callista*, *M. iringensis*).

3. North-central Zambia, southern and eastern Shaba: 14 species, 5 endemic (*M. brevifolia, M. unifoliata, M. balundana, M. bovonei, M. upembana*).

Subgenus *Vieusseuxia* is predominantly eastern in distribution and though it occurs from Ethiopia to Rhodesia, it does not extend anywhere in tropical Africa west of longitude 24°E, and is thus absent from Angola and the Nigeria-Cameroon highlands. Almost as wide ranging as subgenus *Grandiflora* in tropical Africa, subgenus *Vieusseuxia* is poor in species, with only 7 species north of South Africa, and only 4 of these exclusive to tropical Africa. Significant speciation in subgenus *Vieusseuxia* occurs only in the Southern Highlands of Tanzania where two very striking species, *M. callista* and *M. iringensis*, are endemic. Other species of subgenus *Vieusseuxia* are widespread, with *M. thomsonii* extending over almost the entire range of the subgenus in tropical Africa, and found from Ethiopia in the north to Transkei in southern Africa.

Subgenus *Grandiflora* is well represented in tropical Africa by 16 species, only two also found in South Africa where an additional 11 species occur. The only really widespread species of this subgenus in tropical Africa is *M. schimperi* which extends over the whole range of *Moraea* in tropical Africa. Other species are considerably more restricted, and several species are known from single collections or a very small area. *Moraea inyangani* is one example while several species in the *M. tanzanica-M. unifoliata* alliance of reduced species are also very local, especially *M. unifoliata, M. balundara, M. bovonei*, all from Shaba, Zaïre, *M. brevifolia* in northeastern Zambia, and *M. tanzanica* in southwestern Tanzania-northern Malawi. A very marked center of speciation for subgenus *Grandiflora* is evident in this belt across south-central tropical Africa.

HISTORY

The first collections of *Moraea* from tropical Africa were made as early as the 1840s when Schimper discovered *M. schimperi* in Ethiopia. Schimper's collections were first assigned to two separate species in the genus *Hymenostigma*. Knowledge was later extended by Welwitsch who collected *M. schimperi, M. clavata*, and *M. textilis* in Angola in the years following 1853. Welwitsch's Angolan Iridaceae were only described much later, in 1878, by Baker who actually admitted seven species from Angola including three now regarded as conspecific, and referred to *Ferraria* rather than *Moraea*.

The important milestone in the knowledge of *Moraea* in tropical Africa is J. G. Baker's (1898) treatment for *Flora of Tropical Africa*. Baker recognized 16 species in his treatment. However, four of these are clearly the same species of *Ferraria, F. glutinosa*, one is today regarded as *Dietes*, while of the remaining 11 species *M. welwitschii, M. zambeziaca*, and *M. diversifolia* are conspecific (*M. schimperi*) and another two, *M. textilis* and *M. mechowii*, are also regarded here as the same species. A last species, *M. bella*, was until recently associated with the Cape endemic *M. angusta*, although it is in fact unrelated. By 1898 only seven of the presently recognized species were known, six were named and one misidentified.

Subsequent studies on *Moraea* were carried out independently by German, Belgian, and British botanists who confined their interests largely to the colonies of their respective countries. In particular, de Wildeman, working on the flora of what is now Zaïre and Burundi, described six species, all new for the Congo, but four of which have proved to be synonyms of earlier species from other parts of tropical Africa. More recently, *Moraea* has received very little systematic attention in tropical Africa. In fact, the recent treatment by Geerinck (1970) for Zaïre and Burundi is the only significant work in the last fifty years. Geerinck recognized six species, one tentatively; and subsequently one more (Geerinck, 1972). Geerinck's species concepts were far broader than those held by me and I recognize several more species in the Zaïre-Burundi area than Geerinck did. In the present revision 9 of the 24 species are new to science. Knowledge of the genus in tropical Africa is, however, far from satisfactory, and several species are known from one locality while collections of some species are incomplete, lacking corms or fruits or adequately preserved flowers.

ECOLOGY

HABITAT

Moraea occurs in two distinct types of habitat in tropical Africa, either in dry situations in grassland and open woodland or in wet, marsh situations known in southern Africa as vleis, and in south tropical Africa as dambos. Dambos may be seasonal or permanent, but have the characteristic of being poorly drained yet seldom deep, and usually have a rich vegetation including many grasses, sedges, as well as geophytes and herbaceous dicots. The dry habitat may comprise more than a single niche for *Moraea*, but data available does not indicate this, rather suggesting that species may be fairly tolerant of minor ecological differences and thus growing equally well in open woodland or grassland of various types. Most species, though not all, appear to be restricted to either one or other of the two major habitats. Records suggest that *M. ventricosa* and *M. textilis* are exceptions, as they are listed as having been collected in woodland, grassland, or on the edges of marshes. Personal observation has shown that *M. schimperi* also occurs from wet marshes to open, well-drained grassland, the latter habitat being occupied only in areas of higher rainfall.

FLOWERING TIME

Species of *Moraea* may be found in bloom almost throughout the year, though few species flower in the dry season. Peak blooming time is mid wet season. Each species, however, has its own fairly limited flowering period, and detailed examination of flowering times suggests that this factor is of considerable significance in the evolution of the genus in tropical Africa. In general, it appears that only a few species, and only one in each subgenus, may bloom in a particular habitat in any given locality at one time. Species of *Moraea* tend to bloom for about two months; thus in a particular area several species might occur, each flowering at a different time. The significance of flowering times is elaborated further in the following discussion on evolution.

EVOLUTION

The pattern of species that prevails in *Moraea* in tropical Africa suggests that the group is rapidly evolving into a limited number of spatial, temporal, and ecological niches available to the genus. A very limited degree of important floral differences suggests that there has not been sufficient time for fundamental morphological changes to become established in the flowers, so that selection for different pollinators has not been accomplished.

There are three major groups which are dealt with separately in the following discussion: the large-flowered *M. spathulata-M. textilis* series of subgenus *Grandiflora*; the smaller flowered and morphologically specialized *M. tanzanica-M. unifoliata* series of subgenus *Grandiflora*; and the small uniformly blue-flowered subgenus *Vieusseuxia*.

1. The *Moraea spathulata-M. textilis* series.

The series comprises vegetatively similar, large-flowered species in which both flowering time and habitat differences have played the major role in their evolution.

The dry habitat does not support species of subgenus *Grandiflora* in the dry season, with the possible exception of the poorly known September-blooming *M. upembana*. Early in the wet season, from December, *M. verdickii* blooms in Tanzania, Zambia, and Zaïre. *Moraea ventricosa* follows in this region with a blooming peak in March. Subsequently, at least in the east, in Malawi and Tanzania, *M. macrantha* blooms from March to June, lasting into the beginning of the dry season.

In the wet habitat, the wide-ranging *M. schimperi* blooms from September to early December south of the equator. It is replaced later in the season by a variety of more localized species of the series dealt with in the following section, including *M. brevifolia* in Zambia, *M. unifoliata*, *M. bovonei*, and *M. balundana* in Zaïre. Later, towards the end of the wet season, *M. bella* blooms in Zambia, Zaïre, Malawi, and Tanzania.

Geographical isolation is of relatively minor significance in the evolution of this series but has played a role as in *M. ventricosa-M. textilis*, which occupy similar habitat and temporal niches but have different geographical ranges. A similar role for geographical isolation is seen for *M. verdickii-M. spathulata*.

2. The *Moraea tanzanica-M. unifoliata* series.

The species of this series are all relatively small in size, have similar yellow flowers, and exhibit distinctive vegetative modifications making them easy to recognize. Unlike the previous series, all, with the exception of the poorly understood *M. upembana*, occupy a similar habitat and flower at the same time. Spatial isolation is the major factor of evolutionary significance here, with each species relatively limited in range and none sympatric. Small, local populations are characteristic in the series.

3. Subgenus *Vieusseuxia*.

Subgenus *Vieusseuxia*, also a group where species have very similar flowers, exhibits a similar pattern of evolution to subgenus *Grandiflora* with ecological factors assuming dominance over a secondary geographic element. The dry grassland habitat supports *M. thomsonii* in the later dry season; *M. carsonii* in the early to mid wet season at least in the south; *M. afro-orientale* in similar situations north in Tanzania, Kenya and Uganda; and *M. iringensis* locally. In the wet habitat, *M. natalensis* blooms in the wet season throughout south tropical Africa. There are no late-blooming species and presumably taller grasses shade out these smaller plants in late season.

The exception to the patterns described above is the very striking *M. callista*. This species has a large and very different flower from its allies and, although it presumably evolved in isolation, it is now distinguished by its floral peculiarities and, by inference, has a distinctive series of pollinators.

Summarizing, two main modes of evolution appear to have been operative in the tropical African species of *Moraea*. These are: (1) an ecological factor (habitat and flowering time) and (2) a geographical (spatial) factor. Within the two major groups, subgenera *Grandiflora* and *Vieusseuxia* (excluding *M. callista*), floral differences are small and probably not of adaptive significance, so that the species of each group do not appear to have evolved in response to pressures from pollinators.

This situation is similar in the summer rainfall area of southern Africa, although somewhat more complex, with more species and basic types, and an element of floral evolution is evident in section *Vieusseuxia*. However, the evolutionary pattern in the winter rainfall region is quite different. Flowers vary considerably and floral adaptation is of the greatest significance. Evolution for limited and specific ranges of pollinators consequently must have been important. Flowering time and habitat are minor as most species grow in essentially similar situations and all are spring blooming. Soil differences assume great importance as does the geographical factor. Related species are often isolated from one another geographically or by distinct soil preferences. The evolutionary patterns here, in fact, are typical of an area with a Mediterranean climate (Raven, 1973).

TAXONOMIC CHARACTERS

The morphology and important taxonomic characters were dealt with at length in my recent paper on *Moraea* in the winter rainfall region of southern Africa and little need be added here. It will, however, be helpful if I summarize the important features of the two subgenera that occur in tropical Africa.

Subgenus *Grandiflora* comprises the largest-flowered species in the genus, though a few specialized species in tropical Africa—e.g. *M. clavata*, *M. angolensis*, and *M. unifoliata* have relatively small flowers. Floral morphology is uniform apart from size and color, most species having yellow flowers, only *M. schimperi*, *M. ventricosa*, *M. macrantha* and *M. textilis* having blue flowers. Outer tepals are outspread, the inner ± erect. All species are unbranched, and have a single leaf, usually well developed and basal, but in a few species reduced and inserted well above ground level. All species in which fruits are known have large flattened ± discoid seeds and large capsules. The subgenus extends from the southern Cape in South Africa to Nigeria and Ethiopia but

TABLE 1. Chromosome number in tropical African *Moraea*. An asterisk (*) indicates a count for South African material only; new counts are in bold type.

Species	Diploid number 2*n*	Collection data or reference
M. carsonii	12	Goldblatt, 1976a
M. elliotii	12*, 24*	Lewis, 1966; Goldblatt, 1976a.
M. natalensis (as *M. erici-rosenii*)	12	Lewis, 1966.
M. thomsonii (as *M. stricta*)	12	Chimphamba, 1974.
	48	Malawi, Zomba Mt., *Goldblatt s.n.* (no voucher).
	24*, 36*	Goldblatt, 1971.
M. spathulata (incl. subspp.)	12*	Goldblatt, 1971, 1976a.
M. schimperi	12	Goldblatt, 1971; Chimphamba, 1974. Malawi, Zomba Mt., *Goldblatt 4259* (MO). Malawi, Chikangawa-Mzuzu, *Goldblatt 4590* (MO). Malawi, Mzuzu, Marymount, *Pawek 5833* (MO).
M. *macrantha* (as *M. textilis*)	12	Goldblatt, 1976a.
	12	Malawi, Mzuzu, *Pawek 5396* (MO). Malawi, Katumbi-Nyika intersection, *Goldblatt s.n.* (no voucher).
M. ? ventricosa (flowers not seen)	**12**	Burundi, Mt. Bona, E. Bujumbura, *Goldblatt s.n.* (no voucher).
M. tanzanica	**12**	Malawi, Nyika Plateau, Juniper forest road, *Pawek 6660* (MO).

is notably absent from the southwestern Cape, an important center for the genus as a whole.

Subgenus *Vieusseuxia*, composed of two sections of which only section *Polyanthes* occurs outside South Africa, comprises small to fairly large plants all with very similar blue (to white) flowers, which in tropical Africa are quite small and in marked contrast to subgenus *Grandiflora*. Tepals of both whorls are outspread, the exception being *M. callista* from southwestern Tanzania which has unusual, large blue and white flowers with reflexed tepals. Species vary in leaf number and position of insertion which ranges from basal to just below the inflorescence in *M. natalensis*. *Moraea carsonii* has 2–3 leaves, *M. callistra* has two, while other species typically have one leaf. Seeds of all species, where known, are small and angular and capsules are small. The subgenus extends from the southwestern Cape to Ethiopia but is absent from West Africa and Angola. Section *Polyanthes* is the more widespread, with section *Vieusseuxia* restricted to Africa south of the Limpopo.

CYTOLOGY

Moraea is well known chromosomally (Goldblatt, 1976a), some 65% of the 95 species having been studied. It is least well known in tropical Africa and only 9 of the 24 species have now been counted. Counts for the genus in tropical Africa are summarized in Table 1, where several new counts are presented.

The tropical African species have fairly uniform karyotypes, with a base number of $x = 6$. The chromosome complement in all species of subgenus *Grandiflora* examined is similar and all species are diploid, $2n = 12$, with 4 large telocentric pairs, and two ± acrocentric pairs. Satellites are located on a telocentric pair (Goldblatt, 1976a: 13). *Moraea schimperi* is distinctive in having a secondary constriction on the end of the long arm of an acrocentric pair, a feature also noted by Chimphamba (1974).

In subgenus *Vieusseuxia* the chromosomes are acrocentric with the longest pair almost metacentric (Goldblatt, 1976a: 13). Polyploidy has been reported in both sections. In section *Polyanthes, M. thomsonii* is heteroploid with tetraploid and hexaploid plants recorded in South Africa and an octoploid from Malawi. Chimphamba (1974) has reported $2n = 12$ in this species but determination needs to be confirmed and the locality is unknown. *Moraea elliotii* is also heteroploid, with diploidy and tetraploidy reported in South African plants.

The cytological uniformity of *Moraea* in tropical Africa, especially in subgenus *Grandiflora*, contrasts with a great degree of heterogeneity in South African winter rainfall area species. This uniformity supports my suggestion based on limited morphological variation that *Moraea* is of fairly recent origin in tropical Africa.

TAXONOMIC TREATMENT[3]

Moraea Miller, Figs. Pl. 159, *tab.* 238. 1758, as *Morea* and altered to *Moraea* by Linnaeus, nom. cons. TYPE: *M. vegeta* L.

For complete synonymy and generic description see Goldblatt (1976b).

Distribution: Sub-Saharan Africa, in highland areas in the tropics, at all altitudes in temperate southern Africa; species concentrated in South Africa, mainly in the southwestern winter rainfall region.

KEY TO THE SPECIES

1. Produced leaves 2 or more, well developed.
  2. Sheathing portion of upper (cauline) leaf more than 1.5 cm long.
    3. Stem few to many branched; spathes 2.5–5 cm long .... 1. *M. carsonii*
    3.′ Stem simple or 1-branched; spathes 4–6 cm long .... 2. *M. callista*
  2.′ Sheathing portion of upper leaf 2–6 mm long .... 3. *M. afro-orientale*
1.′ Produced leaf solitary, occasionally reduced and ±bractlike or lacking at flowering time.
  4. Plants either leafless at flowering time, or with a dry withered leaf attached; blooming in the dry season.
    5. Flowers yellow; outer tepals 2.7–4.5 cm long .... 21. *M. upembana*
    5.′ Flowers pale blue violet; outer tepals 1.5–2.2 cm long .... 7. *M. thomsonii*

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[3] All major collections of African flora were consulted for this study, and unless otherwise stated all type specimens were seen. Field work was carried out in Malawi and to a limited degree in Rhodesia.

Specimens examined are generally arranged in accordance with modern floristic projects for particular areas. Modern place names are used, but old names where well known or recently altered, are provided in parentheses.

Collection data or literature citation for chromosome numbers in the descriptions are given in the section on CYTOLOGY.

4.′ Plants with a green produced leaf at flowering time, usually well developed but occasionally very short and inserted just below the inflorescence.

6. Leaf inserted immediately under the inflorescence (leaf sometimes bract-like and almost entirely sheathing).

7. Flower blue; stem usually branched .... 6. *M. natalensis*

7.′ Flowers yellow; stem simple.

8. Outer inflorescence spathe only slightly shorter than the inner.

9. Leaf barely distinguishable from the spathes and not or only shortly exceeding them .... 24. *M. unifoliata*

9.′ Leaf several times longer than the spathes .... 22. *M. bovonei*

8.′ Outer inflorescence spathe less than half as long as the inner .... 23. *M. balundana*

6.′ Leaf inserted from the base to the upper part of the stem but not immediately below the inflorescence.

10. Outer tepals 1.4–3.5 cm long.

11. Sheathing portion of bract leaves at least 1.5 cm long.

12. Flowers blue; outer tepals 1.4–2.5(–3.0) cm long.

13. Leaf inserted in the upper third of the stem .... 6. *M. natalensis*

13.′ Leaf inserted in the lower third of the stem .... 5. *M. elliotii*

12.′ Flowers yellow; outer tepals (2.0–)2.5–3.5 cm long.

14. Bract leaf solitary .... 20. *M. clavata*

14.′ Bract leaves 3 or 4.

15. Spathes 5–8 cm long; bract leaves 5–8 cm long .... 11. *M. inyangani*

15.′ Spathes 4.5–5.5 cm long; bract leaves 3.0–4.5 cm long .... 12. *M. angolensis*

11.′ Sheathing portion of bract leaves 1–7 mm long.

16. Ovary 3–5 mm long; anthers 4–5 mm long .... 3. *M. afro-orientale*

16.′ Ovary 7–13 mm long; anthers ±6 mm long .... 4. *M. iringensis*

10.′ Outer tepals 3.8–10 cm long.

17. Bract and spathes ±dry at flowering time and the flowers blue and blooming at the end of the dry season to early in the wet season (Sep.–Dec. south of the equator, Dec.–May north of the equator); leaf often shorter than the stem, the prophylls dark brown and prominent .... 9. *M. schimperi*

17.′ Bracts and spathes at least partly herbaceous at flowering time, or if not, the flowers white to yellow and not flowering at the end of the dry season; leaf exceeding the stem, or if not, flowers white to yellow.

18. Leaf inserted above ground level, very short and rarely exceeding the spathes, the bract leaves usually solitary .... 19. *M. brevifolia*

18.′ Leaf ±basal or if inserted well above the ground, then the bract leaves 1 or 2, the leaves not exceeding the spathes or the plants no more than 35 cm high.

19. Plants of Rhodesia, southern Mozambique (and South Africa).

20. Flowering in spring and early summer, Sep.–Nov., usually in moist habitats; 30–50(–70) cm tall; leaf ca. 5 mm wide .... 10. *M. muddii*

20.′ Flowering in summer in open grassland; usually more than 50 cm tall; leaf usually more than 1 cm wide .... 8. *M. spathulata*

19.′ Plants of Angola and occurring north of Rhodesia and southern Mozambique.

21. Plants 30–35 cm tall with 2 bract leaves only and the leaf only shortly or not exceeding the spathe .... 18. *M. tanzanica*

21.′ Plants usually more than 40 cm tall, if less, then the bract leaves more than 2 and the leaf much exceeding the spathes.

22. Bracts not overlapping.
    23. Flowers blue.
        24. Outer tepals 5.5–8 cm long; corm tunics of pale, reticulate fibers; plants of Zaïre, Tanzania, Zambia, Malawi .... 15. *M. macrantha*
        24.′ Outer tepals 4.7–6 cm long; corm tunics of wiry, dark fibers; plants of Angola .... 17. *M. textilis*
    23.′ Flowers yellow.
        25. Flowering Nov. to Feb. (Mar.), usually in open grassland; anthers 10–14 mm long; outer tepals 5–10 cm .... 14. *M. verdickii*
        25.′ Flowering (Feb.) Mar. to July in damp situations; anthers 8–10 mm long; outer tepals 4.5–5.5(–6.5) cm .... 13. *M. bella*
22.′ Bracts overlapping.
    26. Flowers blue.
        27. Outer tepals more than 5.5 cm long .... 15. *M. macrantha*
        27.′ Outer tepals less than 5.5 cm long.
            28. Anthers 8–10(–11) mm long; inner tepals 3.7–4.5 cm long; plants of Zaïre, Zambia, Burundi, Tanzania .... 16. *M. ventricosa*
            28.′ Anthers (10–)10.5–15 mm long; inner tepals 4.8–6.5 cm long; plants of Angola .... 17. *M. textilis*
    26.′ Flowers white to yellow.
        29. Anthers 8–10 mm long; bract number 3–4(–5) .... 16. *M. ventricosa*
        29.′ Anthers 10–15 mm long.
            30. Outer tepals 5–10 cm long; bract leaves 2–3(or 4 but then the tepals more than 5 cm) .... 14. *M. verdickii*
            30.′ Outer tepals 4.5–6.5 cm long; bract leaves (4–)5–7 .... 17. *M. textilis*

Subgenus VIEUSSEUXIA (de la Roche) Baker—Section POLYANTHES Goldbl.

1. **Moraea carsonii** Baker, Bull. Misc. Inform. 1894: 391. 1894. TYPE: Zambia, Mbala (Abercorn) district, "Fwambo," *Carson s.n.* (K, holotype).—FIG. 1A.

M. homblei De Wild., Contr. Fl. Katanga, Suppl. 4: 7. 1932. TYPE: Zaïre, Shaba (Katanga), near Kolwezi, *Homblé 1024* (BR, holotype).

Plants small to medium in size, 20–40 cm high, usually bearing several branches. *Corm* ca. 1.5 cm in diameter; tunics of dark brown, fine to medium reticulate fibers. *Prophylls* dry and papery, pale brown, the upper often torn somewhat distally, occasionally becoming fibrous. *Leaves* 2, occasionally 3, the lower ±basal or inserted well below the branches, the upper cauline, canaliculate, 2–5 mm wide, usually falcate, exceeding the infloresence; sheath of upper leaf 1.5–2 cm long. *Spathes* occasionally reddish, herbaceous below, becoming dry from the apex, the margins dry, pale brown, the apices dark brown, attenuate; inner spathe 3.2–5.0 cm long, the outer about two-thirds the inner.

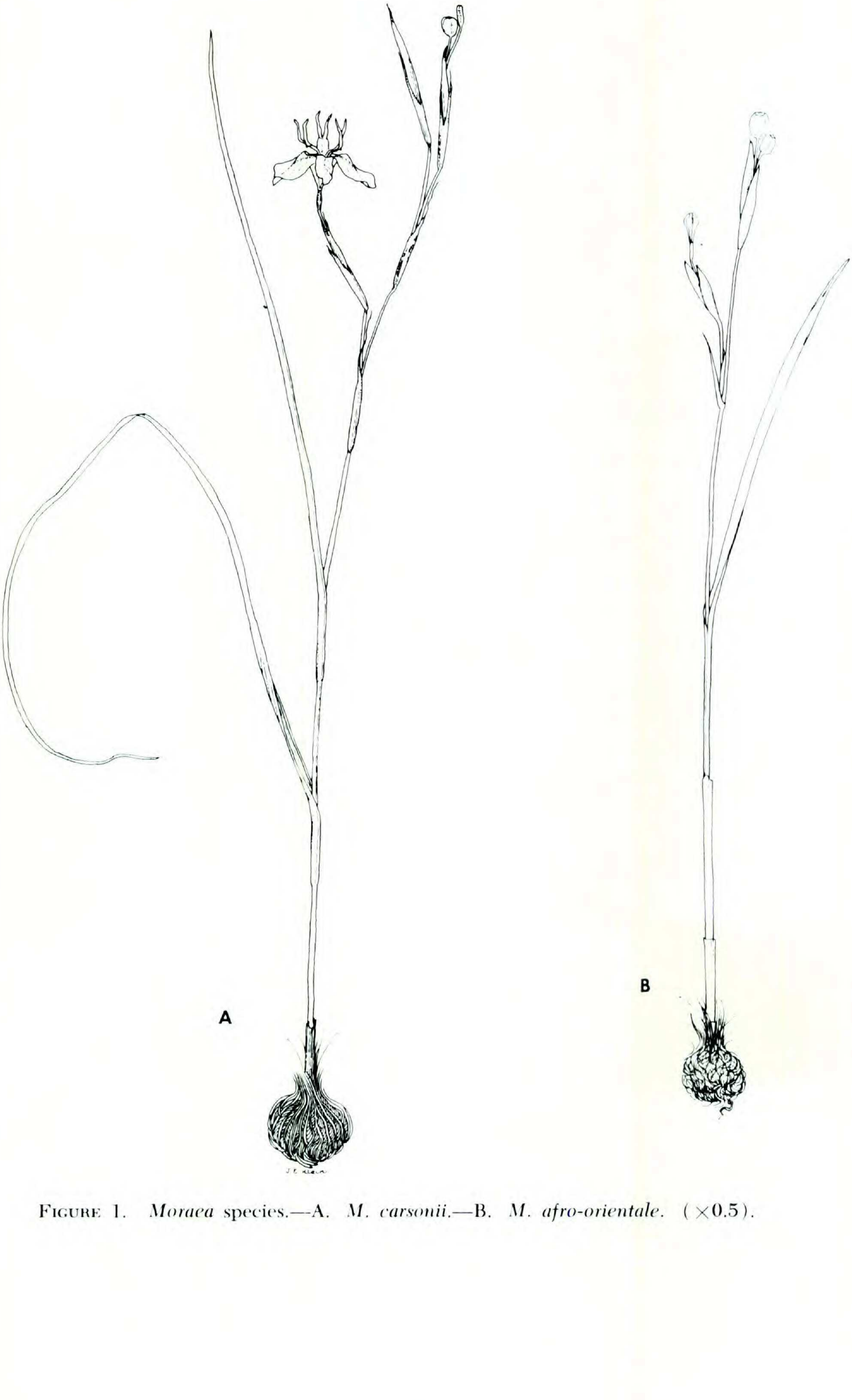

FIGURE 1. *Moraea* species.—A. *M. carsonii.*—B. *M. afro-orientale.* (×0.5).

Flower blue with yellow nectar guides; *outer tepals* 2.1–3 cm long, lanceolate spreading, the limb slightly longer than the claw; *inner tepals* 2–2.8 cm long, spreading. *Filaments* ca. 7.5 mm long, free in the upper third; *anthers* 4.5–5.5 mm long. *Ovary* 3.5–7 mm long; style branches 8 mm long, the crests 7–10 mm long. *Capsule* ovoid, to 8 mm long; *seeds* small, angular. Chromosome number $2n = 12$.

Flowering time: December to February.

Distribution: Rhodesia, Zambia, Malawi, southern Zaïre.—FIG. 2.

Its two or sometimes three leaves, indeterminate growth pattern with several to many branches and small unspecialized flowers, place *M. carsonii* in a primitive position among the tropical African species of the genus. It clearly belongs in subgenus *Vieusseuxia* section *Polyanthes* and is probably most closely allied to the South African, southern Cape species, *M. polyanthos*, which generally has three leaves and similar flowers, and also to the widespread southern African *M. polystachya*, a taller species with much larger flowers. *Moraea carsonii* appears to represent a link between these two multi-leafed southern African species and the several tropical and South African summer rainfall region species of section *Polyanthes*, most of which have a very similar flower but only a single leaf, and are distinguished mainly by differences in growth form.

Moraea carsonii has a relatively wide range, occurring in the Zaïre province of Shaba (Katanga), in northern and eastern Zambia, and adjacent Malawi. A somewhat different form is found to the south in the Inyanga highlands of Rhodesia, which is generally more robust, and has larger flowers, giving it a resemblance to *M. polystachya* to which it is frequently referred. Not all plants from Inyanga are equally robust, and several collections cannot be distinguished from plants occurring further north. For this reason the Inyanga populations are not accorded taxonomic recognition here.

In Tanzania and northwards to the Sudan *M. carsonii* is replaced in similar habitats by *M. afro-orientale* Goldbl., which has until now been included in *M. carsonii* (Burtt, 1938). *Moraea afro-orientale* differs in having a single basal leaf inserted below ground, smaller flowers, and fewer branches which are often clustered in umbellate fashion. Occasionally, particularly in southern Tanzania, forms occur with two leaves but the upper leaf has an unusually short sheath.

MALAWI. NORTHERN REGION: Mtwalo-Mzimba road, *Pawek 3358* (K, MAL). Vipya hills S of Mzuzu, *Pawek 4421* (K). SW Mzuzu, *Pawek 8051* (MO, SRGH). 5 km S Mt. Hora, Rumphi district, *Hillard & Burtt 4456* (K, MAL, SRGH). CENTRAL REGION: Kongwe Mt. near Dowa, *Robson 1654* (BM, LISC, PRE, SRGH).

RHODESIA. EASTERN REGION: Mt. Inyangani, *Plowes 2153* (PRE, SRGH); *Davidse, Simon & Pope 6536* (MO); *Norlindh & Weimarck 4968* (BM, BR, K, PRE, SAM); *West 7010* (SRGH); *Wild 4927* (K, LISC, MO, PRE, SRGH). Near Bonda Mission, *Wild 5478* (COI, K, MO, PRE, SRGH). Above Rhodes Hotel, Inyanga, *Whellan & Davies 997* (SRGH). Nyamaropa Forest Reserve, Inyanga, *Dale SKF204* (K, SRGH); *Drewe 28, 54* (SRGH); *Wild 7495* (BR, K, LISC, PRE, SRGH, MO). Inyanga Downs, *Wild 5475* (K, MO).

ZAÏRE. SHABA: 10 km S of Lubumbashi (Elizabethville), *Schmitz 1286* (BR). Lubumbashi, *Salèsiens 1062* (BR). Fungurume, *Symoens 14023* (BR, K).

ZAMBIA: CENTRAL REGION: Lusaka, *Angus 1466* (K, LISC, SRGH). Kafue River, *Allen 498* (K, SRGH). Kundalila Falls, Serenje district, *Strid 2900* (K). NORTHERN REGION: Mbala township, *Sanane 986* (K). Near Nakatali, *Richards 8023* (K). Kalambo Falls, Mbala

(Abercorn), *Richards 3933* (K). Sansia Falls, Mbala district, *Richards 7436* (K). Mbesuma ranch, *Astle 1185* (K, SRGH). WESTERN REGION: Luanshya, *Fanshawe 1739* (BR, K, SRGH). Mufulira, *Fanshawe 11749* (SRGH). Ndola, *Fanshawe 612* (BR, K).

2. **Moraea callista** Goldbl., sp. nov. TYPE: Tanzania, Southern Highlands, Elton Plateau, *Richards 7562* (K, holotype; BR, isotype).—FIG. 3A.

Planta 30–70 cm alta. *Cormus* ignotus. *Folia* duo, canaliculata, inferius basale, caulis simplex vel uniramosus. *Spathae* inflexae, herbaceae, exterior 4–6 cm longa, interior 3–4.5 cm longa. *Flores* caeruleo-malvini, tepala albescentes distale; *tepala exteriora* 3–3.5 cm longa, limbis 2–2.5 cm longis, reflexis; *interiora breviora*, reflexa. *Filamenta* ad 8 mm longa; *antherae* 6 mm longae. *Germen* 5–7 mm longum; rami styli ca. 8 mm longi; cristae 5–7 mm longae.

Plants solitary, simple or rarely 1-branched, 30–70 cm high. *Corm* not known. *Prophylls* membranous, the uppermost dry and fibrous towards the apex. *Leaves* 2, the lower basal and larger, the upper cauline, to 7 mm wide, canaliculate with slightly thickened hyaline margins, as long as, or slightly exceeding the inflorescence. *Spathes* often inflexed, herbaceous, with dry upper margins; outer spathe 4–6 cm long, the inner ca. ⅔ the inner. *Flowers* blue mauve with the tepals fading to white distally; *outer tepals* 3–3.5 cm long, the limb 2–2.5 cm, fully reflexed when open; *inner tepals* somewhat smaller, also reflexed. *Filaments* to 8 mm long, united in the lower 5 mm; *anthers* 6 mm long. *Ovary* 5–7 mm long; style branches ca. 8 mm long, very broad and outspread, the crests 5–7 mm. *Capsule* and *seeds* unknown. Chromosome number not known.

Flowering time: January to February in the west, May in the east.

Distribution: Southwestern and eastern Tanzania in mountain grassland, 1,800–3,000 m.—FIG. 2.

Moraea callista stands apart from the other species in section *Polyanthes* because its large striking flower with blue and white, fully reflexed tepals are quite distinct from the usual small, uniformly blue flowers with spreading tepals of other species. It occurs in two widely separated areas, high mountain grassland in the Njombe area in the southwestern part of Tanzania, and to the east in the Uluguru mountains where only one gathering has been made, flowering at a much later date, in May, compared to January and February in the western part of its range. The species is known from very few collections and is all too little understood.

TANZANIA. SOUTHERN HIGHLANDS: Elton Plateau, *Procter 1646* (EAH); *Richards 7562* (BR, K). Mangale-Njombe road, *Richards 14216* (K). Mwakete, Njombe district, *Richards 7823* (K). MOROGORO DISTRICT: Mzumbi, *Semsei 1707* (EAH, K, PRE).

3. **Moraea afro-orientale** Goldbl., sp. nov. TYPE: Uganda, Northern Province, Mt. Debasien, *Hedberg 1953* (UPS, holotype; EAH, K, S, isotypes).—FIG. 1B.

Planta 15–40 cm alta, gracilis. *Tunicae* cormi brunneae, reticulatae, tenuis. *Folium* solitarium, basale, raro folio secundo caulino, canaliculatum. *Caulis* ramosus, ferens bracteae sole vel folio caulinum unum, vagina brevissima. *Spathae* herbaceae, interior 2–3.5 cm longa, exterior 1–2 mm brevior. *Flores* caerulei; *tepala exteriora* 1.8–2.6 cm longa, effusa; *tepala interiora* 1.5–1.8 cm longa. *Filamenta* ca. 5 mm longa; *antherae* ca. 4.5 mm longae. *Germen* ad 8 mm longum; rami styli ca. 5 mm longi; cristae ad 5 mm longas.

Plants small, solitary, usually few branched, 15–40 cm high. *Corm* ca. 1.5 cm in diameter; tunics brown, cancellate to reticulate, of medium to fine fibers.

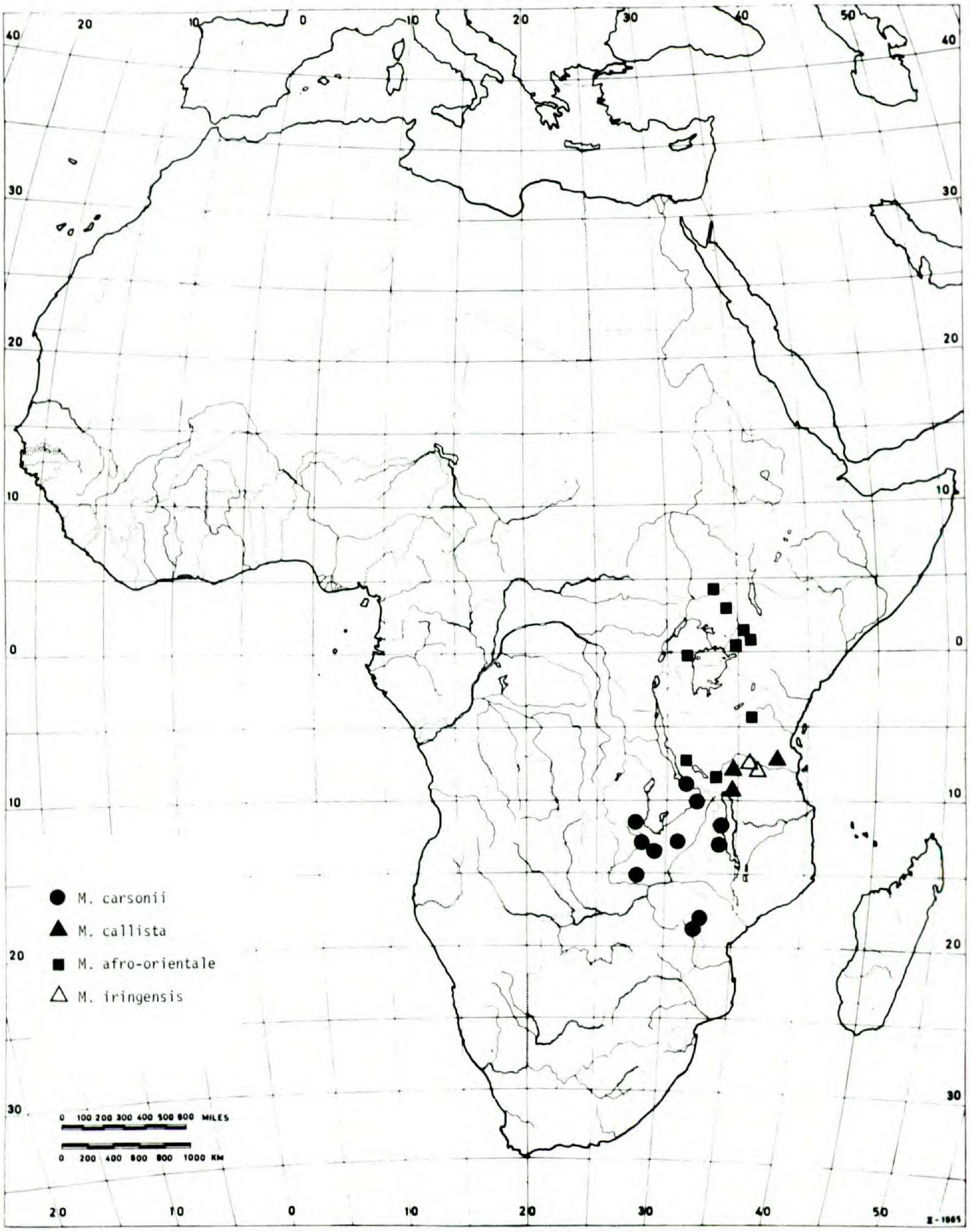

Figure 2. Distribution of *Moraea carsonii*, *M. callista*, *M. afro-orientale*, and *M. iringensis*.

Prophylls usually 3, membranous, entire, obtuse-truncate. *Leaf* usually solitary, basal, inserted below the ground, the base covered by prophylls, canaliculate, 2–5 mm wide, relatively short, as long as or slightly exceeding the inflorescence; occasionally a second leaf developed at the first aerial node, usually bractlike, but 2–10 cm long, occasionally also exceeding the inflorescence; cauline leaf sheath 3–6 mm long. *Spathes* subequal, herbaceous, the margins membranous, rarely dry but not brown, the apices acute, brown tipped; inner spathe 2–3.5 cm long, the outer 1–2 mm shorter. *Flowers* blue with orange nectar guides; *outer tepals* 1.8–2.6 cm long, lanceolate, the limb slightly longer than the claw, spreading; *inner tepals* 1.5–1.8 cm long. *Filaments* ca. 5 mm long, free in the upper third; *anthers* ca. 4.5 mm long. *Ovary* 3–5 mm long; style branches ca. 5 mm long, the crests to 5 mm. *Capsule* ovoid, to 8 mm long; *seeds* small, angular. Chromosome number not known.

Flowering time: April to May north of the equator in Kenya, Uganda, and Sudan; December to January south of the equator.

Distribution: Southern Sudan, western Kenya, Uganda, and central and western Tanzania; in short grass and often in seasonally waterlogged ground, blooming soon after the start of the rainy season.—FIG. 2.

Moraea afro-orientale is closely allied to *M. carsonii*, from which it is probably derived, and it has until now been included in this species. It differs, however, in several respects and is distinctive in overall habit, with prominent membranous prophylls, short stem and few, often clustered branches. Most forms have only a single comparatively short and erect leaf, inserted below ground level in contrast with the two long, flaccid leaves in *M. carsonii*. In the southern part of its range, in central and western Tanzania, *M. afro-orientale* often has two leaves, but when this is the case, the upper, cauline leaf is always distinctive in having a very short sheath (2–5 mm), contrasting with the more usual longer sheath (10–20 mm) in *M. carsonii* and its other relatives. In the single-leafed northern forms of *M. afro-orientale* the second leaf is reduced to a bractlike structure, often with a short free apex, and this bract also has a very short sheath.

Moraea afro-orientale shares this distinctive, very short leaf or bract sheath with two other tropical African species, *M. iringensis*, which has a larger flower and a long ovary which is included in the spathes, and *M. callista*, which has two large leaves, and a large striking flower with blue and white, fully reflexed tepals. Both these species occur rather locally in southwestern and central Tanzania on the southern extremity of the range of *M. afro-orientale* (Fig. 2).

KENYA. NYANZA PROVINCE: Bungoma district, *Kokwaro 134* (EAH). SE slopes of Mt. Elgon, *Padwa 16* (EAH, F, K, PRE, SRGH). RIFT VALLEY PROVINCE: Elgon and Trans Nzoia, *Tweedie 444* (K). Kitale-Suam Mill road, *Bally 2487* (K). Slopes above Endebess, *Polhill 411* (BR, K, PRE). Mt. Elgon, *Rayner 545* (K); *Lugard 573* (K); *Adamson 513* (EAH, K). Endebess, *Webster 9018* (EAH).

SUDAN. EQUATORIA: Mt. Lotuke, Didinga Mts., *Jackson 1333* (BM); *MacDonald 91* (BM); *Myers 10952* (K).

TANZANIA. CENTRAL PROVINCE: Singida-Dodoma, *Feirarzl 5708* (EAH). SOUTHERN HIGHLANDS: Igurussi, Mbeya district, *Procter 2284* (EAH, K). Ruaha National Park, Magangwe Hill, *Bjornstad 2231* (EAH, K). WESTERN PROVINCE: Moanzi, Sumbawanga district, *Vezey-FitzGerald 1378* (K, SRGH). Kuturia-Lukunga confluence, Ufipa district, *Richards 10259* (BR, K). Above Malonje, near Sumbawanga, *Richards 7210* (K).

UGANDA. BUGANDA PROVINCE: Mengo, *Dradu 846* (EAH). EASTERN PROVINCE: Butiro, *Liebenberg 846* (K). NORTHERN PROVINCE: Karamoja district, Lodoketeminit, near Moroto, *Kerfoot 995,4947* (EAH, K). Mt. Debasien (Kadam), *Hedberg 1953* (EAH, K, S, UPS). Moruita, *Eggeling 5785* (BR, K). Karamoja, *Thomas 2836* (BR, K).

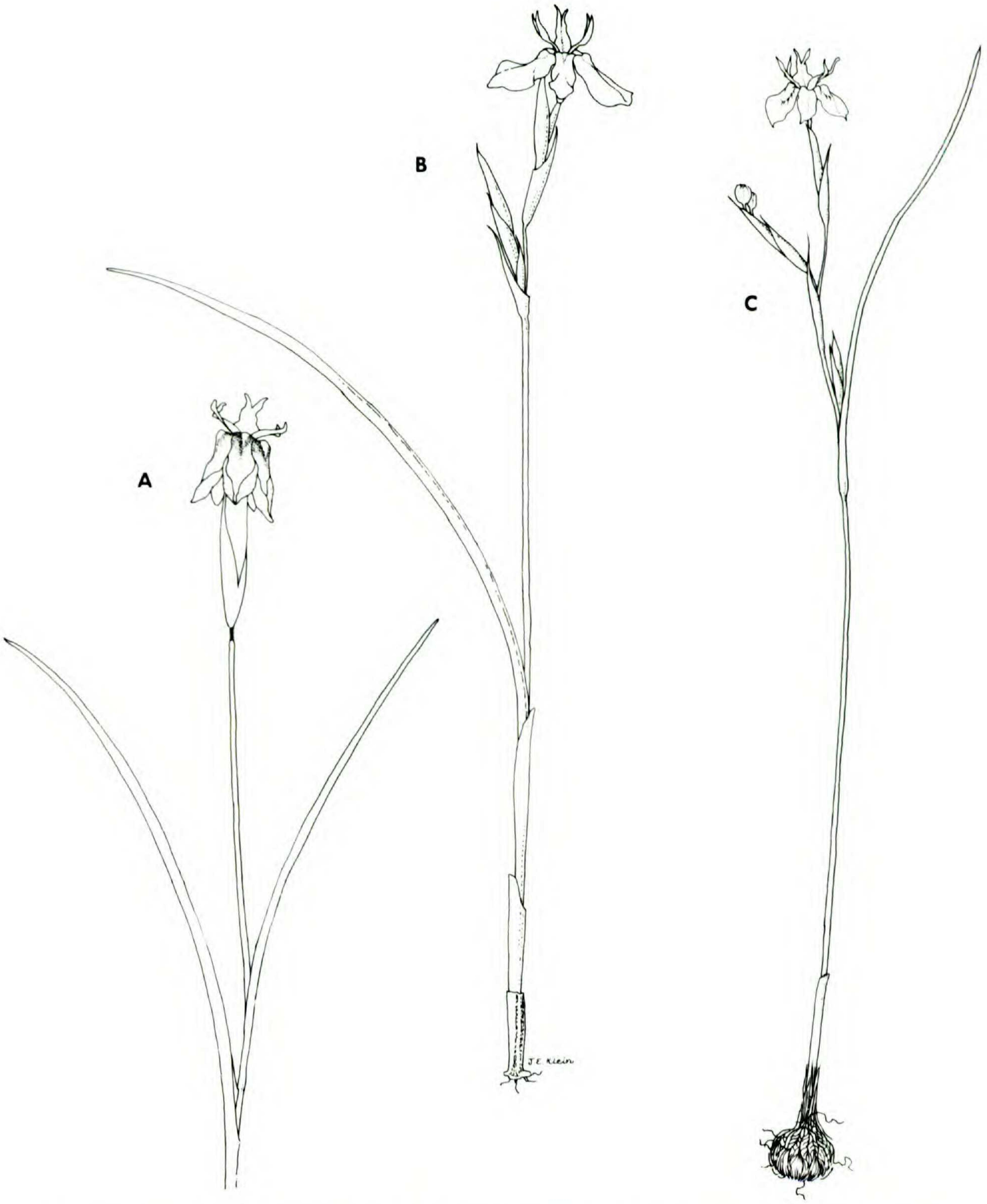

FIGURE 3. *Moraea* species.—A. *M. callista.*—B. *M. iringensis.*—C. *M. natalensis.* (×0.5)

4. **Moraea iringensis** Goldbl., sp. nov. TYPE: Tanzania, Southern Highlands, Kyimbila-Tandala, *Stolz 2362* (K, holotype; BM, BR, PRE, isotypes.)—FIG. 3B.

Planta 15–30 cm alta. *Folium* solitarium, basale, usitate parum inflorescentium brevior, canaliculatum. *Caulis* pauciramosa ferens bractea una vaginis brevissimus. *Spathae* herbaceae, interior 3–4.5 cm longa, exterior 1.5–2.3 cm longa. *Flores* caerulei; *tepala exteriora* ca. 3 cm longa, effusa; *interiora* ca. 2 cm longa, effusa. *Filamenta* ca. 7 mm longa; *antherae* ad 6 mm

longas. *Germen* 8–12 mm longum, non exsertum; rami styli ca. 1 cm longi; cristae ad 8 mm longas.

Plants solitary, (10–)15–30 cm high, usually branched. *Corm* ca. 1 cm in diameter; tunics of fine to medium reticulate fibers. *Prophylls* 2–3, entire, membranous, often red-flushed, obtuse-truncate. *Leaf* solitary, basal, usually slightly shorter than the inflorescence, canaliculate, to 6 mm wide, with slightly thickened hyaline margins. *Bract* leaves to 3 cm long, sheathing at the base only, acuminate. *Spathes* herbaceous, acuminate; inner spathe 3–4.5 cm long, the outer ± half the inner, often with the upper part not sheathing. *Flower* blue; *outer tepals* ca. 3 cm long, lanceolate, the limb ca. 1.5 cm long, spreading to slightly reflexed; *inner tepals* ca. 2 cm long, spreading. *Filaments* ca. 7 mm long, united in the lower third; *anthers* 6 mm long. *Ovary* unusually long, 8–12 mm, enclosed in spathes; style branches ca. 1 cm long, the crests to 8 mm long. *Capsule* and *seeds* not known. Chromosome number not known.

Flowering time: December to January.

Distribution: "Grassland and open *Brachstegia* woodland" in the southern highlands of Tanzania, recorded between Sao Hill and Makumbako, 1,800–2,200 m.—FIG. 2.

Moraea iringensis is closely allied to the more widespread *M. afro-orientale* which occurs in western and central Tanzania, Uganda, western Kenya and the southern Sudan. It differs in being more robust, with larger leaves and flowers, and it is distinctive in having a very long ovary, 8–12 mm long, compared to 3–4 mm in *M. afro-orientale.* In spite of its length, the ovary is almost entirely enclosed in the spathes, in contrast to the exserted ovary found in all allied species.

TANZANIA. SOUTHERN HIGHLANDS: Sao Hill, Iringa district, *Chambers 38* (EAH, K); *Carmichael 331* (EAH); *Robertson 825* (EAH). Kyimbila, Tandala, *Stolz 2362* (K, BM, BR, PRE). Mufindi, *Bjornstad 577* (K). 20 km N of Sunji, Njombe district, *Sturtz 79* (DAR, EAH).

5. **Moraea elliotii** Baker, Handb. Irid. 58. 1892. TYPE: South Africa, Transvaal, marshes near Lake Chrissie, *Scott-Elliot 1592* (K, holotype).

For complete synonymy see Goldblatt (1973).

Plants small to medium, reaching to 55 cm high, usually branched. *Corm* 1.5–2 cm in diameter; tunics of dark brown fairly coarse fibers often extending upwards in a neck. *Prophylls* membranous, becoming dry from above. *Leaf* solitary, terete or linear and canaliculate, inserted near the base or the lower part of the stem, and much exceeding the inflorescence. *Bract leaves* 1–4, 2.5–6 cm long, herbaceous or becoming dry and brown. *Spathes* herbaceous with dry, light brown margins, attenuate; inner spathe 4–6 cm long, the outer ca. 1 cm shorter. *Flowers* blue violet with orange yellow nectar guides; *outer tepals* 2–3 cm long, lanceolate, the limb to 1.5 cm long and 1.2 cm wide, spreading to reflexed at 45°; *inner tepals* 1.5–2.4 cm long, linear-lanceolate. *Filaments* ca. 6 mm long, joined in the lower half; *anthers* ca. 6 mm long. *Style branches* ca. 1 cm long, the crests to 0.5 cm long. *Capsule* ovoid, to 1.2 cm long; *seeds* small, angled. Chromosome number $2n = 12, 24$ (South African collections only).

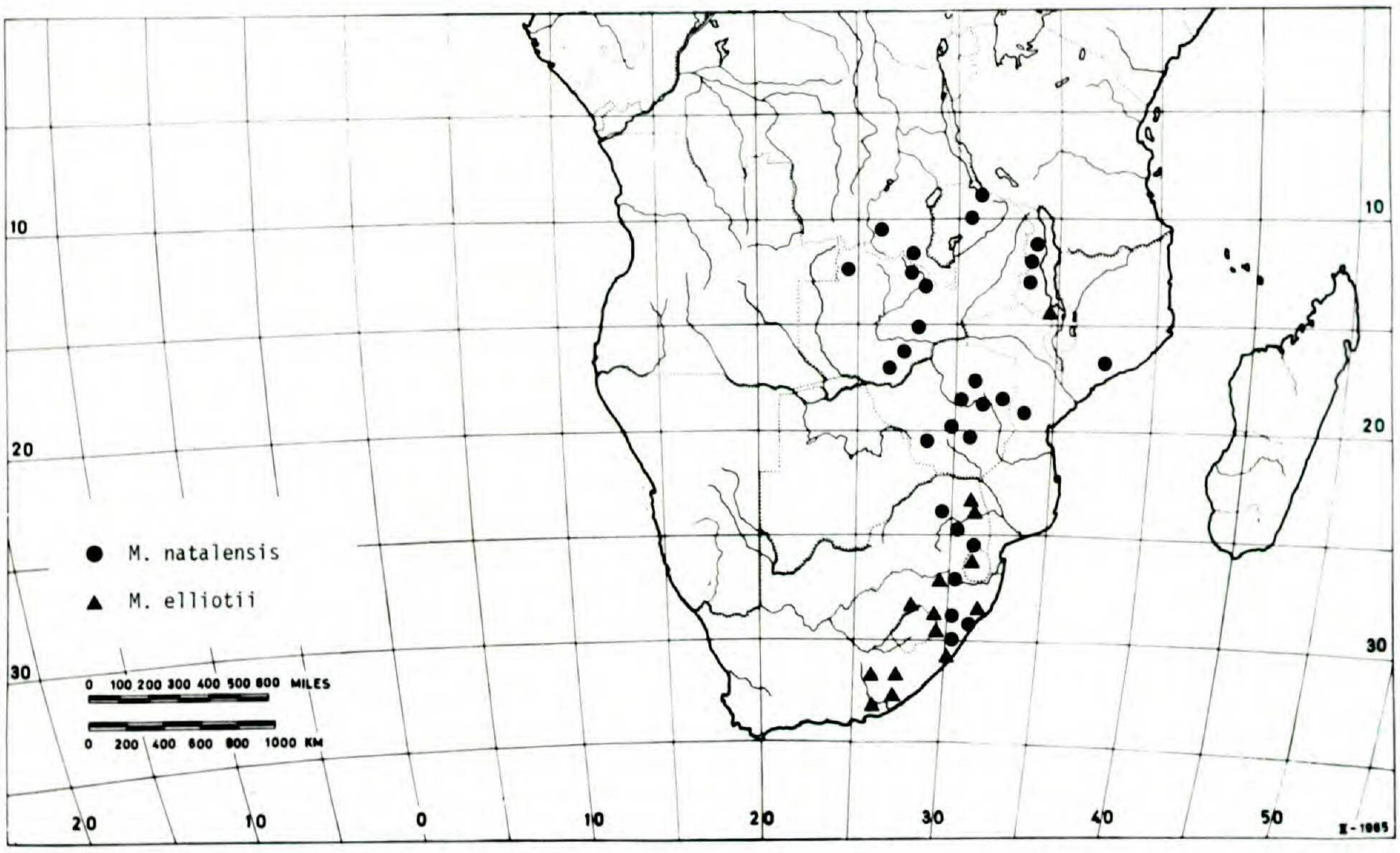

FIGURE 4. Distribution of *Moraea natalensis* and *M. elliotii.*

Flowering time: September to March.

Distribution: Eastern South Africa, Swaziland, and Malawi.—FIG. 4.

Moraea elliotii is fairly common in the grasslands of South Africa, especially in well-watered highland areas. As defined earlier (Goldblatt, 1973), it includes a wide range of forms, from the early, spring-blooming eastern Cape plants with a ±basal canaliculate leaf, to summer-flowering plants from Natal, Transvaal, and Swaziland, also with a canaliculate leaf, but inserted somewhat above ground level, to terete-leafed, usually late-flowering plants, mainly from the eastern Transvaal. A single collection from Malawi is identical with the latter, and though such a gap in distribution from South Africa to Malawi is unexpected, the Malawian collection must be assigned to *M. elliotii.* The species is clearly predominantly South African, and for further details of synonymy, variation and distribution, readers are referred to my earlier treatment of the species (Goldblatt, 1973).

Moraea elliotii is closely allied to species such as *M. carsonii* from Central Africa and *M. polyanthos* from the southern Cape, and all three species have a similar flower. It would seem more specialized in its solitary leaf and relatively few branches than the multi-leafed and branched *M. polyanthos* and the 2-leafed *M. carsonii.* The more reduced *M. natalensis*, with its short leaf inserted well above the ground and with a somewhat contracted inflorescence, probably evolved from multi-leafed ancestors via plants like *M. elliotii*; and *M. natalensis* is also seen as closely related.

MALAWI. CENTRAL REGION: Dedza, summit of Ciwan, Chongoni, *Chapman 1176* (SRGH).

6. **Moraea natalensis** Baker, Handb. Irid. 56. 1892. TYPES: South Africa, Natal, *Sanderson 253* (K, lectotype; S, isolectotype); *Sutherland s.n.* (K, paratype).—FIG. 3C.

M. erici-rosenii Fries, Wiss. Ergeb. Schwed.-Rhod.-Kongo Exp., 1911–1912, Bot. Untersuch. 1: 234. 1916. TYPE: Zambia, Kalambo, *Fries 1345* (UPS, holotype; Z, isotype).
M. parviflora N.E. Brown, Trans. Roy. Soc. S. Africa 17: 346. 1929. TYPE: South Africa, Transvaal, Tomson's vlei, Nylstroom, *Pole Evans 19668* (K, holotype; PRE, isotype).

Plants 15–45 cm high, including the leaf, usually branched. *Corm* to 1.5 cm in diameter; tunics of dark brown to black fibers. *Prophylls* membranous with the upper becoming dry from the apex and often lacerated. *Leaf* inserted well above ground, shortly below the inflorescence, canaliculate to terete, to 20 cm long and shortly exceeding the inflorescence or reduced and about as long as the spathes. *Stem* with the lowermost internode very long, and the produced leaf inserted in the upper part. *Bract leaves* if present seldom exceeding 2.5 cm and usually dry and light brown. *Spathes* herbaceous, becoming dry above, the margins dry and pale brown, the apices attenuate; inner spathe 2–3.5 cm long, the outer ca. 1 cm shorter. *Flowers* blue mauve with yellow nectar guides; *outer tepals* 1.4–2 cm long, lanceolate, the limb 0.7–1.4 cm long, up to 1.0 cm wide, reflexed to 45°; *inner tepals* to 1.5 cm long, reflexed. *Filaments* ca. 5 mm long, united in the lower half; *anthers* 4–5 mm long. *Style* branches ca. 6 mm long, the crests to 5 mm long. *Capsule* ovoid-subglobose, 4.5–10 mm long; *seeds* small, angular. Chromosome number $2n = 12$.

Flowering time: November to January (February).

Distribution: Zambia, Malawi, Rhodesia, Mozambique, South Africa; in moist situations, often in vleis and dambos and in seasonal pools.—FIG. 4.

The most striking characteristic of *M. natalensis* is its leaf insertion which is well above ground level at the top of the long lowermost internode. The leaf itself is relatively short, no more than 20 cm long, but more often smaller and sometimes not exceeding the inflorescence spathes. In some forms, notably in the northern part of its range, in Zambia, the stem above the lower internode is much contracted so that the leaf seems to be inserted almost immediately under the inflorescence. In these forms the leaf is often at its shortest, appearing almost bractlike and easily confused with the inflorescence spathes. The type of *M. erici-rosenii* corresponds to this form. Most other collections from Zambia, and Rhodesia, where the species is very common, resemble the typical South African form with a less contracted stem above a longer leaf. The existence of a whole range of forms from the extremely short-leafed, much-contracted type represented by *M. erici-rosenii* to the relatively long-leafed and extended-stemmed type make it necessary to reduce *M. erici-rosenii* to synonymy.

Moraea natalensis is one of the more widespread species in the genus and occupies a similar ecological niche throughout its range. It occupies rather moist depressions or vleis and dambos in open grassland and in exposed rocky situations which are seasonally moist, and is also found around rock pools. It occurs at moderate altitudes of between 1,000 and 2,000 m, though it is also found near the coast in South Africa. It is most closely related to the predominantly

South African species *M. elliotii*, which has a single leaf inserted lower on the stem, usually shortly above the ground.

MALAWI. CENTRAL REGION: Near Tamanda Mission, *Robson 1093* (BM, K, LISC, PRE, SRGH). Kasungu, *Jackson 2299* (K, MAL, PRE, SRGH). Kasungu National Park, *Hall-Martin 1364* (SRGH). NORTHERN REGION: S. Vipya, Lwanjati Peak, *Pawek 8905* (SRGH, MO).

MOZAMBIQUE. MANICA & SOFALA: 12 km from Vila Pery, *Torre & Correia 13180* (LISC). ZAMBEZIA: Mujeba, on Pibane road, Quelimane district, *Faulkner K152* (BR, K, PRE, S).

RHODESIA. CENTRAL REGION: Marandellas, *Dehn 556* (SRGH); *Rattray 829* (SRGH); *Day s.n.* (SRGH-2129); *Collins 10* (K, SRGH). Rusape, *Hopkins s.n.* (SRGH-6830); *Munch 455* (K, SRGH). Salisbury, *Eyles 1896* (K, PRE, SAM), *3737* (SAM, SRGH), *6099* (BOL, K, SRGH); *Willoughby s.n.* (SRGH). Surprise siding, Selukwe, *Taylor s.n.* (SRGH-2625). Near Que Que, *Bingham 374* (K, SRGH). Gwelo, *Loveridge 540* (K, PRE, SRGH). Darwendale, *Gordon 193017* (K, SRGH). SOUTHERN REGION: Near Fort Victoria, *Plowes 3154* (K, LISC, PRE, SRGH). WESTERN REGION: Bulawayo, *Brain s.n.* (SRGH). Matobo district, *Miller 1998* (K, LISC, MO, PRE, SRGH), *2051* (MO, PRE, SRGH). Matopos, *Borle 58* (K); *Garley 112* (K, SRGH); *Eyles 1144* (ISRGH). Lochview, *Cross 335* (SRGH).

ZAÏRE. SHABA: Lumbumbashi (Elisabethville), *Hock s.n.* (BR). Near Mukumbi, *Hoffmann 962* (BR).

ZAMBIA. CENTRAL REGION: Lusaka, *King s.n.* (K); *Best 4, 10* (K), *82* (SRGH). NORTHERN REGION: Mbala (Abercorn) district, Kalambo Falls, *Richards 19295* (K). 25 km W of Kasama, *Robinson s.n.* (K). SOUTHERN REGION: Machipapa, Mazabuka district, *White 6253* (K). Katomo, Batoka Plateau, *Sykes 267* (K). Kaloma, *Fanshawe 9179* (SRGH); *Mitchell 17/29* (SRGH). Between Chomo and Monze, *van Rensburg 3084* (BM, K, SRGH). Chomo, *Astle 1841* (SRGH); *Lawton 1185* (K, SRGH). WESTERN REGION: Kalenda dambo, Mwinilunga district, *Milne-Redhead 3597* (BR, K, PRE). Zambezi Rapids, Mwinilunga district, *Richards 17146* (K, SRGH); *Lewis 6224* (K, MO). Kitwe, dambo, *Linley 35* (MO, SRGH). Nchanga, *Ferrar s.n.* (SRGH-4800).

7. **Moraea thomsonii** Baker, Handb. Irid. 57. 1892; Bot. Mag. *tab. 7976.* 1904. TYPE: Tanzania, "plateau north of Lake Nyassa," Oct. 1880, *Thomson s.n.* (K, holotype).—FIG. 5.

M. stricta Baker, Vierteljahrsschr. Naturf. Ges. Zürich 49: 178. 1904. TYPE: South Africa, Transvaal, Shilouvane, *Junod 563* (Z, holotype; K, LD, isotypes).

M. tellinii Chiov., Ann. Bot. (Rome) 9: 138. 1911. TYPE: Ethiopia, Begemdir & Simen, Debarek, *Chiovenda 3007* (F, lectotype); several other types cited, all from Ethiopia.

M. curtisae Foster, Contr. Gray Herb. 127: 46. 1939. TYPE: Kenya, Norok, Noyrosera, 60 km SE of Narok, *Curtis 676* (GH, holotype).

M. trita N. E. Brown, Trans. Roy. Soc. S. Africa 17: 347. 1929. TYPE: South Africa, Transvaal, Lydenburg, *Wilms 1419* (K, holotype; P, PRE, isotypes).

M. parva N. E. Brown, Trans. Roy. Soc. S. Africa 17: 347. 1929. TYPE: South Africa, Transvaal, Woodbush, *Moss 15564* (K, holotype).

M. mossii N. E. Brown, Trans. Roy. Soc. S. Africa 17: 347. 1929. TYPE: South Africa, Transvaal, Johannesburg, *Moss 15805* (K, holotype; PRE, isotype)

Plants small, 12–30 cm high, branched, leafless when in flower. *Corm* 1–2 cm in diameter; tunics dark brown, of tough reticulate fibers. *Prophylls* dry and irregularly broken. *Leaf* solitary, quite dry, or lacking at flowering time, occasionally a new leaf emergent and then not attached to the flowering stem, slender, terete, long and trailing. *Branches* short to ±sessile, subtended by dry bract leaves. *Spathes* usually quite dry and papery at flowering, acuminate, becoming lacerated with age; inner spathe 2.5–4 cm long, the outer 5–10 mm shorter. *Flower* pale blue lilac with yellow orange nectar guides; *outer tepals* 1.5–2 cm long, lanceolate, the limb to 1 cm, spreading; *inner tepals* 1.4–1.7 cm long, erect, becoming outspread. *Filaments* 4–5 mm long, free in the upper third; *anthers*

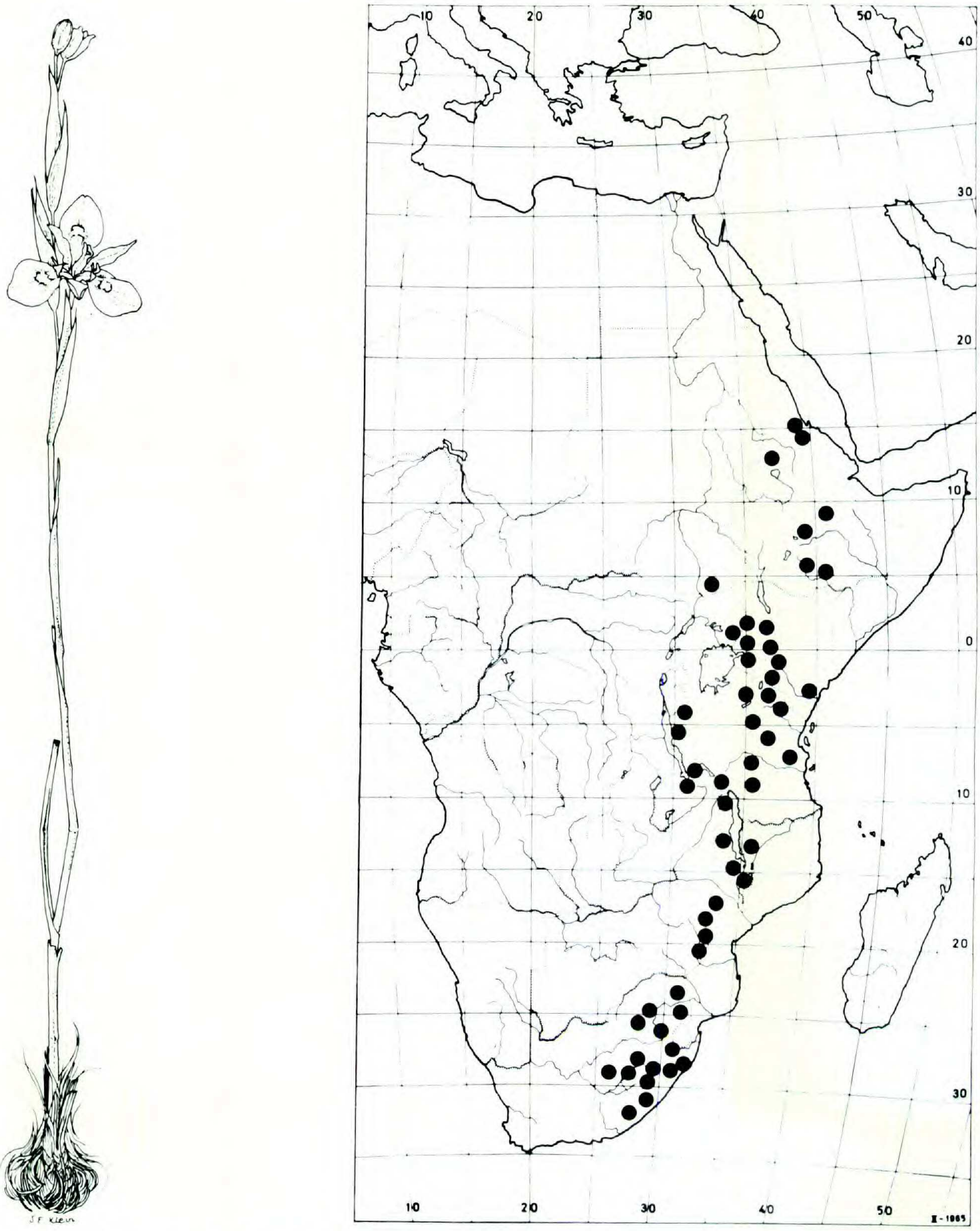

FIGURE 5. Morphology and distribution of *Moraea thomsonii* (×0.5).

4–5 mm long. *Style branches* 7 mm long, the crest vestigial or 3–5 mm long. *Capsule* ovoid, ca. 1 cm long; *seeds* small, angular. Chromosome number $2n = 12$, 24, 36, 48.

Flowering time: (August) September to November (December) south of the equator, December to June (August) north of the equator, in the dry season before the rains begin.

Distribution: Widespread, in dry grassland in the eastern half of Africa; extending from the summer rainfall areas of South Africa through Mozambique, Rhodesia, Malawi, and eastern Zambia to Tanzania, Uganda, Kenya and Ethiopia. —FIG. 5.

Several species are reduced here to synonymy in *M. thomsonii*, notably *M. tellinii* from Ethiopia, *M. curtisiae* from Kenya, and *M. stricta* from South Africa. These all differ to a small extent from *M. thomsonii*, but they have its characteristic growth habit and peculiar terete leaf, characters which are considered more significant taxonomically than the minor floral differences that are perhaps to be expected in such a widely distributed species.

The typical form of *M. thomsonii* which occurs in Malawi and adjacent Zambia and Tanzania has short, almost vestigial style crests, but has relatively broad tepals and style branches. Plants occurring further to the north and also to the south have well-developed style crests. The northern forms, however, have the broad tepals and style branches of the type, while the South African form, earlier treated as *M. stricta* by me (Goldblatt, 1973), has rather narrow tepals and style branches. Plants occurring in Rhodesia are intermediate between the typical and southern forms and usually have style crests.

Moraea thomsonii is one of the more widespread species in the genus, extending almost the length of the eastern half of Africa, from the eastern Cape Province of South Africa to northern Ethiopia. It occurs in open grassland and typically flowers towards the end of the dry season. The leaf and flowering stem are produced at different times, the long, terete leaf emerging after the first rains, and attaining full size during the wet season. The leaf dies back in the dry season, often becoming broken and decayed by the time the stem and, subsequently, the flowers are produced. Owing to the widespread practice in Africa of burning grasslands at the end of the dry season, the leaf of *M. thomsonii* is often charred or is entirely destroyed, so that flowering specimens frequently lack leaves.

Moraea thomsonii is generally easy to recognize in the herbarium because specimens usually lack leaves, or if these are present, it is obvious that the leaf was dead when collected. Difficulty is sometimes experienced in deciding if the leaf was in fact dry when gathered and then the terete nature of the leaf, the short, often sessile branches and dry, almost transparent spathes are sufficient for determination.

ETHIOPIA. ARUSI: Mt. Chillalo, *Scott s.n.* (K). BEGEMDIR & SIMEN: Debarek, Amhara, *Chiovenda 3007* (F). ERITREA: Hamasen, *Fiori 895* (F). Near Adi Nefas, Hamasan, *Pappi 4149* (F). Amba-Dero, *Pappi 3541* (F). Belesa, Hamasen, *Terraciano & Pappi 343* (F). At Taclesan, *Terraciano & Pappi 415* (F). HARAR: Mt. Achim, *Bally 10054* (EAH, K). SIDAMO: 15 km SE of Meghelli, *Burger 1827* (F, K). Mogada forest, *Mooney 5469* (K). Wadera, *Mooney 5629* (EAH, F, K). 15 km S of Adola, *Bally 3137* (K). Agheremeriam, *Gillett 14549* (BR, EAH, F, K). Between Neghelli and Filtu, *de Wilde 6675* (WAG).

KENYA. COAST PROVINCE: District around Nyora, *Routledge 1908* (K). CENTRAL PROVINCE: Nairobi National Park, *Verdcourt 3284* (K). Between Ngong and Kikuyu, *van Someren 1437* (EAH, K). Nanyuki, *Watt s.n.* (K). RIFT VALLEY PROVINCE: Elgeyo, *Battiscombe 1184* (EAH, K). Kaptagat, *Agnew & Agnew 9031* (MO); *Verdcourt 2148* (EAH, K, PRE). Kapiyet, *Dauglish 82* (K). Trans Nzoia, *Tweedie 443* (K). Mt. Elgon, *Lugard 548* (K). Kitale, *Thorold 2752* (K). NORTHERN FRONTIER: Near Kisima, *Leakey 8544* (K). NYANZA PROVINCE: Tinderet, *Poviano s.n.* (F). SOUTHERN PROVINCE: Near Kongoni River, *Fries & Fries 1538* (K, S, UPS). 60 km SE of Narok, Noyrosera, *Curtis 676* (GH).

MALAWI. NORTHERN REGION: Nyika National Park, *Pawek 1390* (SRGH). Nyika Plateau, *Robson 231* (K, LISS, SRGH). CENTRAL PROVINCE: Between Dedza and Ncheu, *Jackson 148* (K). Clintembwe, Kota Kota district, *Brass 17579* (K, MO). SOUTHERN REGION: Mlanje Mt., *Burtt Davy 21981* (K); *Pawek 3795* (K). Zomba Mt., *Salubeni 89* (MAL, SRGH). Mt. Malosa, *Whyte s.n.* (K).

MOZAMBIQUE. MANICA & SOFALA: Báruè, Serre de Choa, *Mendonça 301* (LISC). Between Skeleton Pass and Chimanimani Plateau, *Grosvenor 225* (LISC, SRGH). NIASSA: Namiamba, near Vila Cabral, *Mendonça 776* (LISC).

RHODESIA. EASTERN REGION: Chimanimani Mts., *Munch 325, 326* (SRGH). The Corner, Chimanimani Mts., *Wild 3350* (K, SRGH); *Sturgeon s.n.* (SRGH-30671, K, LISC, PRE); *Chase 2973* (BM, MO, SRGH). Melsetter, *Plowes 2460* (SRGH), *2800* (LISC, SRGH). Banti North, Umtali, *Chase 7828* (SRGH). Inyanga, *Leach 8139* (K, SRGH). Mare River, Inyanga, *Wild 3859* (K, MO, SRGH). Slopes of Rukotso, Inyanga, *Phipps 734* (SRGH). S of Pungwe View, *Methuen 309* (K).

SUDAN. EQUATORIA: (reported as Uganda) Imatong Mts., *Eggeling 3558* (K).

TANZANIA. CENTRAL PROVINCE: Wotta, Mpwapwa district, *Gane 133* (EAH, K). EASTERN PROVINCE: Morogoro, *Schlieben 1237* (BR, K). NORTHERN PROVINCE: Ngorongoro, *Tanner 3863* (K). Liliondo, Masailand, *Fosbrooke 20* (K); *Gibbins s.n.* (K). W slopes of Kiliamanjaro, *Greenway 6704* (K, PRE). Hanang Mt., *Burtt 4010* (K); *Geilinger 1313* (K, Z). Mpololo, Moshi district, *Haarer 1478* (K). Oldeani Volcano, *Burtt 4232* (K). SOUTHERN HIGHLANDS: Ruhudje-Lupembe, *Schlieben 1237* (K, LISC, MO, PRE). Iringa district, *Greenway 3429* (EAH, K). Mbeya Mt., *Geilinger 2797* (K,Z). WESTERN PROVINCE: Heru, Kasulu district, *Eggeling 6195* (BR, EAH, K). S of Sisaga, Kigoma district, *Jefford & Newbold 1770* (K). Keto Mt., 15 km from Zambia border, *Richards 6186* (K).

UGANDA. Without precise locality, *Bally 10748* (K). NORTHERN PROVINCE: Mt. Debasien, *Eggeling 2693* (K).

ZAMBIA: EASTERN REGION: Lundazi, Nyika Plateau, *Pawek 2854* (K, MAL). NORTHERN REGION: Lumi marsh, Kawimbi, *Richards 6116* (K).

Subgenus GRANDIFLORA Goldbl.

8. **Moraea spathulata** (L.f.) Klatt in Th. Durand & Schinz, Consp. Fl. Afr. 5: 152. 1895.—FIG. 7A.

Iris spathulata L.f., Suppl. Pl. 99. 1781. TYPE: South Africa, Cape, Langkloof, Wolwekraal, *Thunberg s.n.* (Herb. Thunberg 1172, UPS, holotype).

I. spathacea Thunb., Diss. Iride no. 23. 1782. TYPE: as for *I. spathulata* L.f.

Moraea spathacea (Thunb.) Ker, Bot. Mag. *tab. 1103.* 1808, non Thunb., 1787.

M. longispatha Klatt, Linnaea 34: 560. 1866. TYPE: South Africa, Cape, Transkei, banks of Kei River ("Tambikuland"), *Ecklon & Zeyher Irid. 3* (MO, lectotype).

M. spathulata subsp. *transvaalensis* Goldbl., Ann. Missouri Bot. Gard. 60: 253. 1973. TYPE: South Africa, Transvaal, near Sabie, *Goldblatt 610* (BOL, holotype; MO, isotype).

M. spathulata subsp. *saxosa* Goldbl., Ann. Missouri Bot. Gard. 60: 254. 1973. TYPE: South Africa, Transvaal, summit of Long Tom Pass, *Goldblatt 612* (BOL, holotype; PRE, isotype).

M. spathulata subsp. *autumnalis* Goldbl., Ann. Missouri Bot. Gard. 60: 254. 1973. TYPE: South Africa, Cape, Transkei, Nyameni Mouth, Port Edward district, *Strey 8619* (PRE, holotype; NH, isotype).

Plants large, 50–90 cm high, solitary or in small clumps. *Corm* 1.5–2 cm in diameter; tunics of brown, finely reticulated fibers. *Prophylls* prominent, brown to pale, firm in texture, brittle, dry, entire or irregularly broken, or frayed at the apex. *Leaf* solitary, flat or canaliculate, to 1.5 cm wide. *Stem* simple or occasionally bearing one branch. *Bract leaves* 2–3, often dry and brown, to 15 cm long, rarely overlapping. *Spathes* herbaceous, or becoming dry and brown from the apex, attenuate; inner spathe 10–14 cm long, outer ca. ¾ the inner. *Flower* pale yellow; *outer tepals* 3.5–5.5 cm long, the limb 2–3.5 cm, spreading; *inner tepals* 3–4 cm long, erect. *Filaments* 8–12 mm long, free in the upper third;

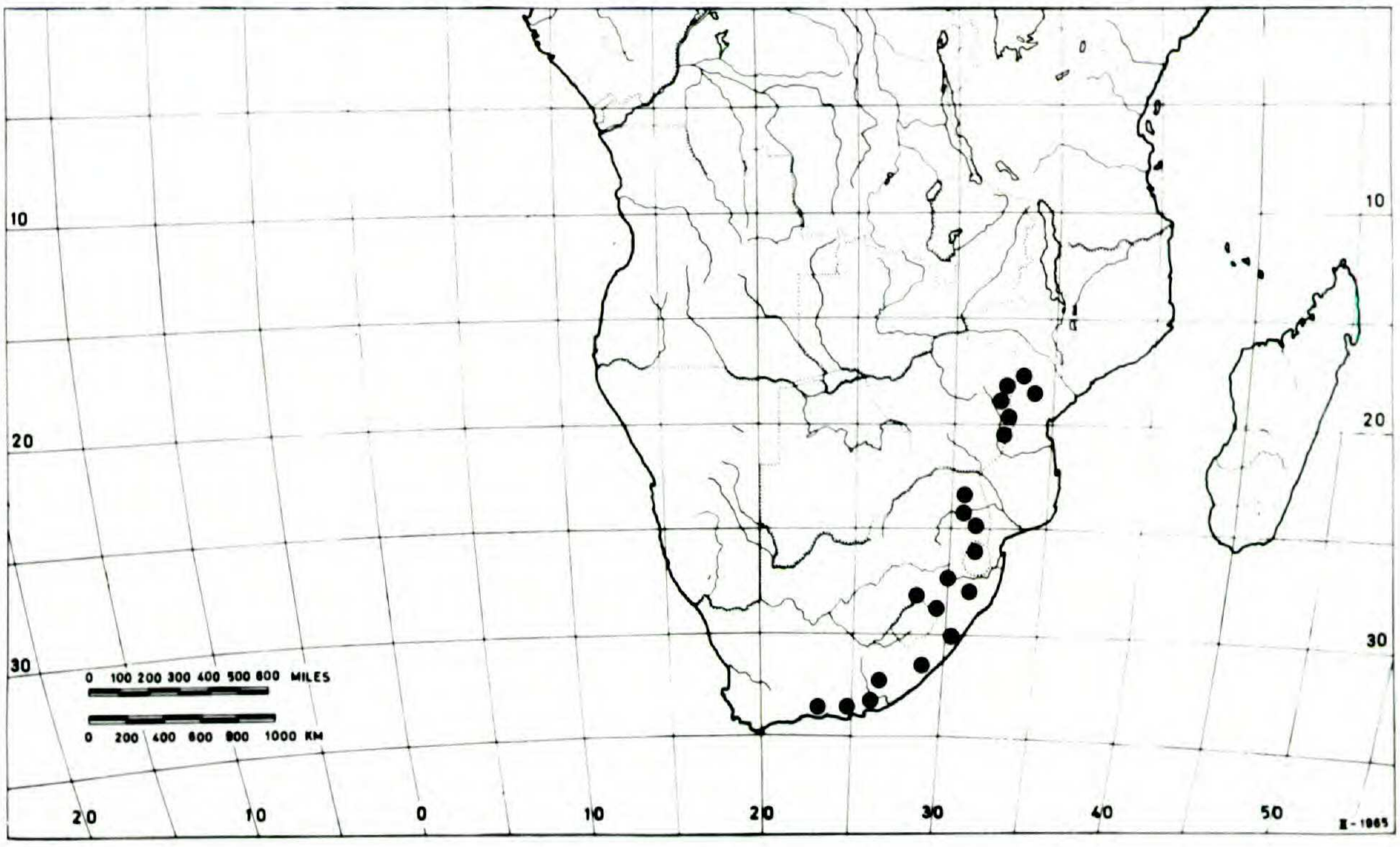

FIGURE 6. Distribution of *Moraea spathulata*.

anthers 8–12 mm long. *Ovary* 2–3 cm long; style branches 1.2–1.8 cm long, the crests to 1 cm long. *Capsule* 3.5–5.5 cm long; *seeds* large, flattened. Chromosome number $2n = 12$ (South African plants only).

Flowering time: (November) December to March (early April).

Distribution: Open grassland in the Inyanga and Chimanimani highlands of Rhodesia and Mozambique, also in South Africa, Lesotho, and Swaziland.—FIG. 6.

The tall, summer-flowering *Moraea* frequently collected in the Chimanimani and Inyanga highlands of Rhodesia and Mozambique is clearly closely allied to the *M. spathulata* complex of South Africa. The plants from the Chimanimanis in particular are virtually identical to the Transvaal and Swaziland forms which I previously referred to *M. spathulata* subsp. *saxosa* Goldbl. (Goldblatt, 1973). Since 1973 when I recognized *M. spathulata* as comprising four subspecies, I have had the opportunity to observe living plants in several places and to see more herbarium material. As a result, it has become clear that my attempt to subdivide *M. spathulata* was not satisfactory, and the proposed subspecies did not accurately reflect the variation found in the species. The subspecies *autumnalis* from the Transkei is merely a very early blooming coastal form and must be included in the typical form. *Moraea spathulata* in the southern part of its range in the Knysna district of the Cape Province blooms from July to September but not unusually in June or even May, thus the March to May blooming subsp. *autumnalis* is not particularly unusual. The remaining two subspecies, subsp. *transvaalensis* and subsp. *saxosa*, both from the Transvaal and Swaziland, differ from one another mainly in that the lower-altitude subsp. *transvaalensis*

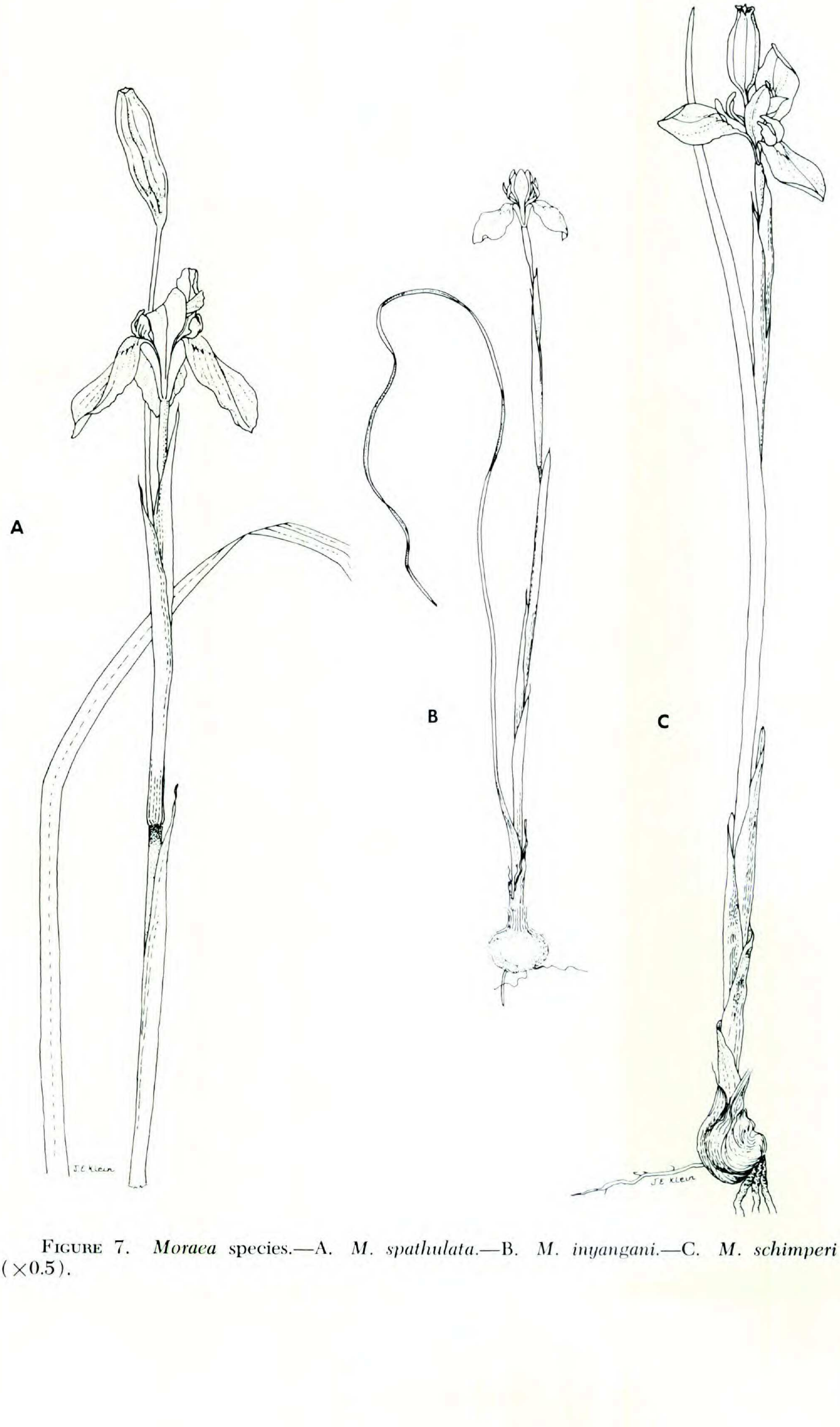

FIGURE 7. *Moraea* species.—A. *M. spathulata.*—B. *M. inyangani.*—C. *M. schimperi* (×0.5).

forms clumps, while the higher-altitude subsp. *saxosa* appears to be predominantly solitary in habit and has a slightly longer ovary and capsule. However, when the entire pattern of variation in *M. spathulata* is considered, both the tendency to solitary habit, and the longer ovary of subsp. *saxosa* and the features of subsp. *transvaalensis* now seem altogether too insignificant to make any taxonomic recognition worthwhile. It seems far more useful to recognize *M. spathulata* as a single, complex, and variable entity.

North of the Limpopo River *M. spathulata* thus extends as far as the Inyanga region of Rhodesia-Mozambique. The largest forms occur in Inyanga, some plants even bearing branches while rather dwarfed forms occur in the Chimanimanis. Differences between the two appear significant until the few collections from the intervening highland areas in Mozambique are considered, and these prove intermediate in all characteristics.

MOZAMBIQUE. MANICA & SOFALA: Tsetserra, *Exell, Mendonça & Wild 332* (LISC); *Torre & Correia 15687* (LISC). Gorongosa Mts., summit, *Tinley 2436* (SRGH). Serra Messambuzi, *Torre & Correia 13302* (LISC). Between Mussapa River and frontier at Tendera, *Torre & Correia 13159* (LISC). Báruè, Serra de Choa, *Torre & Correia 15485* (LISC).

RHODESIA. EASTERN REGION: Melsetter, *Hanmer s.n.* (SRGH-18354); *Chase 1421* (BM, K, SRGH). Melsetter district, Mutsarara farm, *Crook 318* (SRGH). Glendingwe Estate, *Plowes 3477* (SRGH). Pork Pie Hill near Melsetter, *Bamps, Symoens & van den Berghen 776* (BR, SRGH). Inyanga, *Chase 4351* (BM, K). Inyangani Mt., *Chase 8124* (BM, K, LISC, PRE, SRGH); *Plowes 2429* (SRGH); *Whellan & Davies 984* (K, SRGH); *Fries, Nrolindh & Weimarck 4967* (BM, BR, PRE). Mt. Gungingurwe, Stapleford, *Wild 5711* (K, MO, PRE, SRGH). Bant North, Umtali district, *Wild 4522* (K, LISC, MO, PRE, SRGH). Himalayas-Engwa, *Wild 4456* (K, LISC, SRGH). Vumba Mts. near Umtali, *Obermeyer 2113* (PRE).

9. **Moraea schimperi** (Hochst.) Pic.-Serm, Webbia 7: 349. 1950.—FIG. 7C.

Hymenostigma schimperi Hochst., Flora 27: 24. 1844. TYPE: Ethiopia, Begemdir & Simen "Enschedcap," *Schimper 1173* (B, holotype; BM, F, K, M, MO, P, S, isotypes).

H. tridentatum Hochst., Flora 27: 25. 1844. TYPE: Ethiopia, Begemdir & Simen, Barnam, Mt. Bachit, *Schimper 1296* (K, lectotype).

Vieusseuxia schimperi (Hochst.) A. Rich., Tent. Fl. Abyss. 2: 305. 1850 (Hist. Nat. Bot. v. 5).

V. tridentata (Hochst.) A. Rich., Tent. Fl. Abyss. 2: 305. 1850.

Iris diversifolia Steud., m.s. (cf. A. Rich., Tent. Fl. Abyss. 2: 305. 1850).

Xiphion diversifolium Steud. ex Klatt, Linnaea 34: 572. 1866, nom. illeg. superfl. TYPE: as for *Hymenostigma schimperi* Hochst.

Moraea diversifolia (Steud. ex Klatt) Baker, J. Linn. Soc., Bot. 16: 130. 1877.

M. welwitschii Baker, Trans. Linn. Soc. London, Bot., Ser. 2, 1: 270. 1878. TYPE: Angola, Huila, Lopollo River, *Welwitsch 1548* (BM, holotype; K, LISU, P, isotypes).

M. zambeziaca Baker, Fl. Trop. Afr. 7: 340. 1898. TYPE: Zambia, Mangaja hills, *Meller s.n.* (K, holotype).

M. hockii De Wild., Repert. Spec. Nov. Regni Veg. 11: 540. 1913. TYPE: Zaïre, Shaba, between Buggege and Lukoni, *Hock s.n.* (BR, holotype).

Plants 20–40 cm high, unbranched. *Corm* 1.5–2 cm in diameter; tunics brown, fibrous. *Prophylls* 3–5, large and prominent, entire, firm, usually dark brown. *Leaf* solitary, basal, canaliculate to flattened, 9.6–15 mm wide, emerging as flowering begins, but eventually much exceeding the inflorescence. *Stem* usually short at flowering time but elongating in fruit. *Bract leaf* usually solitary, 10–15 cm long, becoming dry and brown. *Spathes* usually dry and brown, (6–)7–10 (–12) cm long; outer spathe about ¾ the length of the inner. *Flower* blue purple with yellow white nectar guides; *outer tepals* lanceolate, 4–6.5 cm long, the limb equal to or slightly exceeding the claw; *inner tepals* erect, 3.5–4.5 cm long. *Filaments* 9–15 mm long, united in the lower half; *anthers* 8–12 mm long. *Ovary* 1.5–2 cm long; style branches 1.5–2 cm long, the crests 1–2 cm long. *Capsule* 2.5–3.5 cm long; *seeds* flattened and ±discoid. Chromosome number $2n = 12$.

Flowering time: From the end of the dry season into the early wet season, August to November (December) south of the equator; November to May, occasionally until July in West Africa and Ethiopia.

Distribution: Widespread from Rhodesia north and west through Central and East Africa, to Angola, Zambia, Malawi, Mozambique, Tanzania, Zaïre, Burundi, Sudan, Ethiopia, Cameroons and Nigeria; often in marshy or wet situations, occasionally in grassland.—FIG. 8.

Moraea schimperi has been given a surprising number of names which seems remarkable in the light of its singular morphology and habit. This is probably explained more by its great geographic range than by any morphological differences, and in fact most of its synonyms have been applied to plants from different areas of Africa. *Moraea schimperi* extends from the Rhodesian-Mozambique highlands in the south, west to Angola and north, through Zaïre and Burundi to southern Sudan and Ethiopia. It also occurs in the higher areas of Nigeria and Cameroons, with a large break in the range over the Congo Basin. Significantly it is also absent from Uganda and Kenya, where the highlands may be of too recent origin for it to have become established.

Moraea schimperi usually occurs near a permanent water source, either underground or at the surface, in a vlei or dambo, or along a stream, but is also found in well-drained grassland in areas of high rainfall. It flowers at the end of the dry season and continues in bloom in the early wet season. Thus in the southern tropics it blooms from September through October and into November and early December. On the equator and to the north, plants most often begin flowering in December to February, and continue into March and May. The morphology of *M. schimperi* is most distinctive. The flowering stem appears before or as the new season's leaf emerges, and early in the season the bright blue flowers are borne well above the leaf apex. The prophylls, bracts, and spathes are large, and their usually rich brown color is alone sufficiently characteristic to permit determination. As the season progresses, stem and leaf continue to grow, and by the time the seeds are ripe the stem may be a meter high and the leaf much longer. There is only a small degree of variation from this pattern, notably in plant size, with forms from Nigeria-Cameroons and also some in Ethiopia being more slender than the comparatively robust plants in the southern part of its range.

Though clearly related to the *M. spathulata* complex, as can be seen from the similarity of the bracts and prophylls, *M. schimperi* is unusual in this alliance in having blue purple flowers. The treatment of *M. schimperi* here differs somewhat from that of Geerinck (1970) in that *M. arnoldiana* is not considered a synonym. The latter is a late-blooming species from Zaïre and is assigned to synonymy under *M. macrantha* in this treatment.

ANGOLA. BIE: Chitembo, *Barbosa & Moreno 12245* (LISC). CUANZA SUL: *Murta & Silva 857* (COI, LISC). HUAMBO: Rio Cuanza, Mucosa, *Monteiro & Murta 1884* (COI,

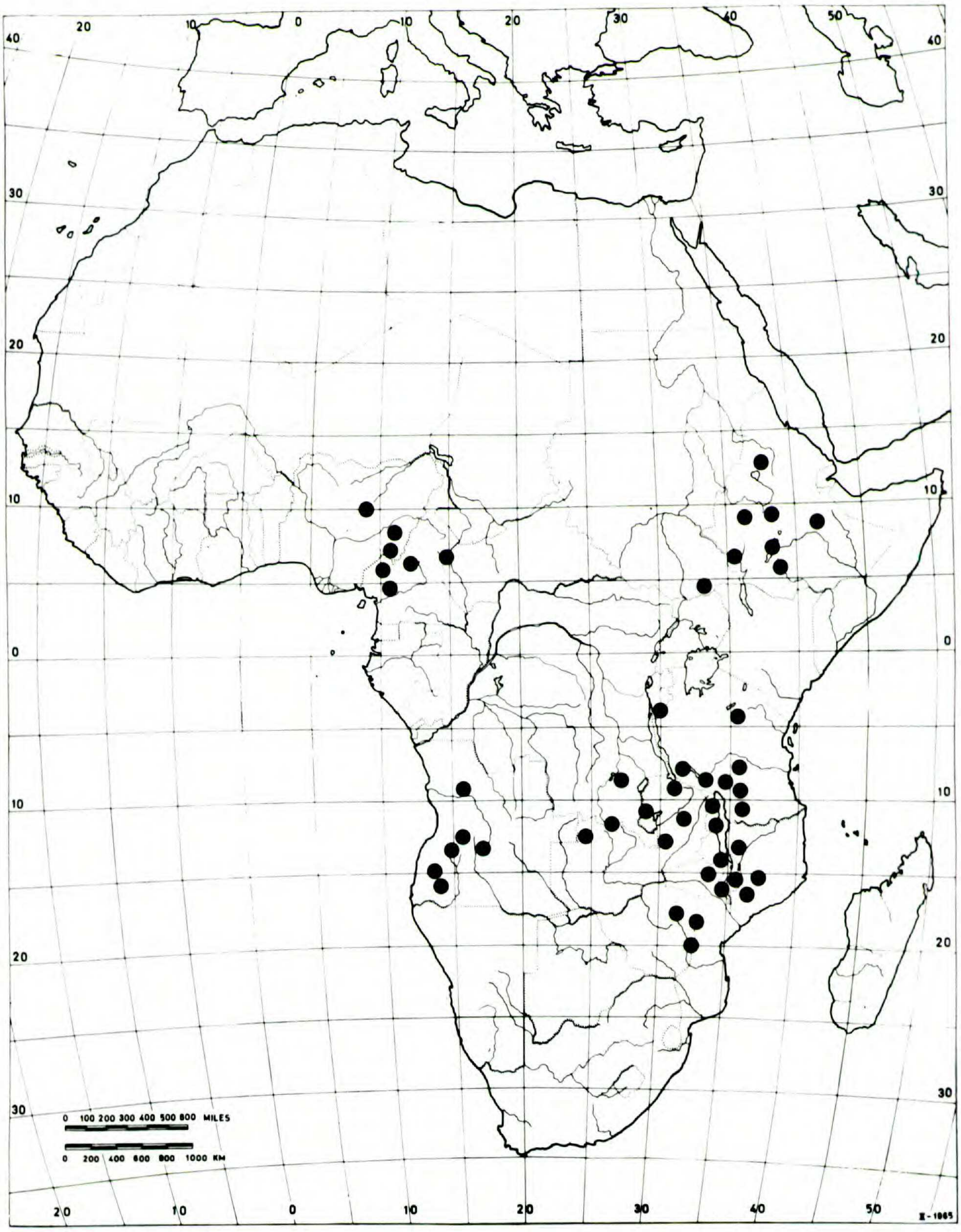

FIGURE 8. Distribution of *Moraea schimperi*.

LISC, SRGH). Huambo (Nova Lisboa), *da Silva 3188* (LISC, PRE). HUILA: Missae Catolica, Huila, *Santos 62* (LISC). Lopollo River, *Welwitsch 1548* (BM, COI, K, LISU, P). Near Vila Arture de Paiva, *Leach & Cannell 13861* (K, LISC). Lubango (Sa de Baneira), Rio Caia, *Henriques & Brites 1137* (K, LISC, LISU, PRE). Humpata, *Mendes 1816* (LISC). Cheila Mts., *Gosseiler 13316, 13317* (LISC). MALANJE: *Gossweiler 922* (P).

BURUNDI. Bururi, *Becquet 162* (BR, EAH, K, WAG); *Reekmans 1041* (BR, EAH). Near Kumuyange, *Lewalle 6131* (BR, MO).

CAMEROON. WEST: *Bauer 22* (K). Bamenda, 4 km NE of Bambili, *Bauer 154* (K). Between Bamenda and Santa, *Keay s.n.* (FHI-28348, K, P). EAST: Nganha Mts., E. Ngoaundéré, *Jacques-Felix 8632* (P); *de Wilde 4521* (WAG). E of Ngoaundéré, *Raynal & Raynal 12236* (P); *de Wilde 4312* (WAG). Dschang, Mt. Bamboutos, *Villiers 672* (P); *Jacques-Felix 2707* (P); *Saxer 88* (K, WAG, Z). Dschang, *Meurillon 765* (BR). Djuttitsa, *Meurillon 179* (BR), *745* (P), *1212* (BR, K, P). Mt. Santa, *Jacques-Felix 2810* (P). Gotel Mts., NNE Banyo, *Letouzey 8592* (P).

ETHIOPIA. ARUSI: Between Shashamane and Dodollo, *de Wilde 6823* (WAG). Near Asela, *de Wilde 6595* (MO, WAG). Near Kofole, *Mooney 7106* (F, K, S). Between Bekoji and Adaba, *Gilbert 1150A* (K). BEGEMDIR & SIMEN: Near Michubbi, *Pichi-Sermolli 2674* (F, K). "Enschedcap," *Schimper 1173* (B, BM, F, K, M, MO, P, S). Sering, *Schimper 1536, 1537* (P). HARAR: Gara Mullata Mts., *Gillett 5332* (EAH, F, K, P, S); *Burger 1706* (K), *2933* (F, K); *de Wilde 6335* (WAG). SHOA: *Negri 413* (F). Between Addis Ababa and the Blue Nile, *Buscalioni 957* (F). Mt. Zuguola, *Buscalioni 2158* (F). SIDAMO: S of Agere Selam, *de Wilde 6721* (WAG). SE of Agere Selam, *de Wilde 10298* (MO, PRE, WAG). WOLEGA: Bari, *Smeds 1241* (K). N of Beica, *Mooney 7729* (EAH, K).

MALAWI. NORTHERN REGION: Chelinda Bridge, Nyika, *Pawek 1407* (SRGH). Nyika Plateau, *Cottrell 3, 65* (SRGH); *Robson 326* (BM, BR, K, LISC, SRGH). Mzuzu, Marymount, *Pawek 5833* (MO, SRGH). Vipya Mts., *Chapman 1702* (K, LISC, SRGH); *Garley 576* (SRGH). CENTRAL PROVINCE: Dedza, *Brass 17632* (K, MO, SRGH); *Kulumule 2* (K, SRGH). Chongoni Forest Reserve, Dedza district, *Salubeni 829* (MAL). SOUTHERN PROVINCE: Chambe Plateau, Mt. Mulanje, *Newman & Whitmore 653* (BR, K, SRGH, WAG). Mt. Mulanje, *Forbes 67* (EAH); *Greenway 6306* (EAH, PRE). Lichenya Plateau, Mulanje Mts., *Pawek 3793* (MAL). Limbe, off Cholo road, *Moriarty 399* (MAL).

MOZAMBIQUE. NIASSA: Amaramba near Mandimba, *Mendonça 666* (LISC). TETE: Between Furancungo and Angonia, *Torre 3362* (LISC). ZAMBEZIA: Namuli hills, *Last s.n.* (K). Near Gurué, *Torre & Correia 15923* (LISC). Serra de Gurué, *Mendonça 2229* (LISC).

NIGERIA. NORTHERN REGION: Vom, Jos Plateau, *Dent Young 245* (K); *McClintock 199* (K). Mambila Plateau, *Tuley 1929* (K); *Latilo & Daramola s.n.* (FHI-34380, BR, K, S, WAG); *Wit, Gbile & Daramola 2076* (FHI); *Hepper 1774* (BR, K, P); *Gbile & Daramola s.n.* (FHI-62880, WAG). Between Nguroje and Maisamari, *Chapman 2640* (FHI). Vogel Peak, *Hepper 1504* (K, P).

RHODESIA. EASTERN REGION: Melsetter, Markhams Kloof, *Crook M151* (K, LISC, MO, PRE, SRGH). Inyanga downs, *Drewe 18* (SRGH). CENTRAL REGION: Salisbury, *Eyles 1791* (K, PRE, SAM, SRGH). Cleveland Dam, *Wild 3871* (K, SRGH). Marandellas, *Rattray 562, 309* (BM, SRGH); *Corby 196* (SRGH).

SUDAN. EQUATORIA: Imatong Mts., *Andrews 1895* (K); *Johnston 1492* (K); *MacDonald 80* (BM). Kippi, *Chipp 89* (K).

TANZANIA. SOUTHERN HIGHLANDS: Poroto Mts., *Geilinger 2611* (K, Z); *McGregor 3* (K, EAH). Between Chunya and Mbeya, *Burtt 6225* (BM, BR, EAH, F, K). Chunya escarpment, *Richards 25795* (K). Njombe district, *Richards 6585* (K); *Gillett 17781* (EAH, K). Itaka, *Greenway 3651* (EAH, K, PRE). Mufindi, *Paget-Wilkes 261* (EAH, MO). Elton Plateau, *Richards 18460* (K, SRGH); *Davies s.n.* (K). SOUTHERN PROVINCE: 8 km W of Songea, *Milne-Redhead & Taylor 8377* (K). NORTHERN PROVINCE: Between Dongobesh and Mkulu, *Haarer 11613* (K). WESTERN PROVINCE: Sumbawanga, *Van Rensburg s.n.* (EAH).

ZAÏRE. SHABA (Katanga): Gare de Biano, *Schmitz 4893* (BR, WAG). Kipopo, *Schmitz 5495* (BR). Parc Nationale de l'Upemba, *Robyns 3940* (BR). 70 km S of Jadotville, *Schmitz 4055* (BR). Lubudi, Kendo, *de Witte 537* (BR, WAG, Z).

ZAMBIA. NORTHERN REGION: Mbala (Abercorn) district, Lumi River flats, *Richards 5844* (BR, K, SRGH). Ndundu, Mbala district, *Richards 13138* (K, SRGH). Mansa (Fort Rosebery), *Fries 608* (UPS). N of Lake Shiwa Ngandu, *Greenway & Trapnell 5709* (EAH). CENTRAL REGION: Serenje, *Fanshawe 6727* (SRGH). EASTERN REGION: Nyika Plateau, *Robinson 3012* (K, M, PRE, SRGH). WESTERN REGION: N of Kakema River, Mwinilunga district, *Milne-Redhead 965* (PRE).

10. **Moraea muddii** N. E. Brown, Trans. Roy. Soc. S. Africa 27: 346. 1929. TYPE: South Africa, Transvaal, Mac Mac Creek, Sabie district, *Mudd s.n.* (K, holotype).

Plants 15–40(–70) cm high, solitary. *Corm* ca. 1.5 cm in diameter; tunics fine, usually pale. *Prophylls*, short, dry, pale brown, usually irregularly broken. *Leaf* linear, canaliculate ca. 5 mm wide, exceeding the inflorescence. *Stem* unbranched. *Bract leaves* 2–4, herbaceous, 8–12 cm long. *Spathes* herbaceous; inner spathe 7–12 cm long, the outer ca. ¾ the inner. *Flowers* yellow; *outer tepals* lanceolate, 3.5–5 cm long, the limb 2–3 cm long; *inner tepals* to 3.5 cm long, erect. *Filaments* to 1 cm long, free in the upper third; *anthers* 8–11 mm long. *Ovary* ca. 1.5 cm long; style branches to 1.3 cm long, the crests to 1 cm long. *Capsule* ca. 2 cm long; *seeds* flattened and disc shaped. Chromosome number not known.

Flowering time: Late August to November.

Distribution: Eastern mountains of southern Africa, from the eastern part of the Cape Province to the Chimanimani Mountains of Rhodesia and Mozambique; usually in wet situations in grassland.—FIG. 9.

The few collections of a rather short, large yellow-flowered *Moraea* from the Chimanimani Mountains of Rhodesia and Mozambique match very closely *M. muddii*, a species previously recorded only from South Africa. The Chimanimani plants resemble *M. muddi* not only in form, but like it, are early blooming, and generally occur in moist habitats.

The range of *M. muddii* extends from the Chimanimanis south, along the eastern escarpment of South Africa to the Hogsback in the eastern Cape. The Rhodesia-Mozambique plants differ mainly in their rather early flowering, from August to September, in contrast to October to November in South Africa, but otherwise correspond very closely.

Moraea muddii is related to the *M. spathulata* complex, particularly to solitary-growing species such as *M. moggii*, *M. hiemalis*, and *M. carnea*, amongst others, and is distinguished by its shorter size, often smaller flower, and early blooming habit.

MOZAMBIQUE. MANICA & SOFALA: Near summit of Chimanimani Mts., *Grosvenor 195* (LISC, SRGH, UPS, WAG).

RHODESIA. EASTERN REGION: Chimanimani Mts., *Garley 177* (SRGH); *Loveridge A42* (SRGH). Bank of Bundi River, Melsetter district, *Whellan 2153* (SRGH).

11. **Moraea inyangani** Goldbl., sp. nov. TYPE: Rhodesia, vlei on Mt. Inyangani, 8,000 ft, *Wild 5519* (SRGH, holotype; K, LISC, M, PRE, isotypes).—FIG. 7B.

Planta parva, 15–30 cm alta. *Tunicae* cormi pallidae, tenuissimae. *Folium* solitarium, canaliculatum, inflorescentium excedens. *Caulis* simplex ferens 3(–4) bracteis. *Spathae* herbaceae, interiora 5–8 cm longa, exterior paulo brevior. *Flores* luteis; *tepala exteriora* ca. 2.5 cm longa, limbo ca. 1.5 cm longo, effuso; *interiora* 1.5–2 cm, erecta. *Filamenta* 4 mm longa; *antherae* ca. 6 mm longae. *Germen* ca. 1.4 cm longum; rami styli 8–9 mm longi; cristae 4–8 mm longae.

Plants small 15–30 cm high. *Corm* to 1 cm in diameter; tunics of fine, pale fibers. *Prophylls* brown, papery, irregularly broken. *Leaf* solitary, canaliculate, appearing terete with the margins tightly inrolled, to 3 mm wide and exceeding the inflorescence. *Stem* unbranched. *Bract leaves* 3(–4), herbaceous, 5–8 cm long. *Spathes* herbaceous with dry, brown acute apices; inner spathe 5–8 cm long, the outer only slightly shorter. *Flowers* pale yellow; *outer tepals* ca. 2.5 cm long, lanceolate, the limb ca. 1.5 cm long, spreading; *inner tepals* erect, 1.5–2 cm long. *Filaments* 4 mm long, free in the upper half; *anthers* ca. 6 mm

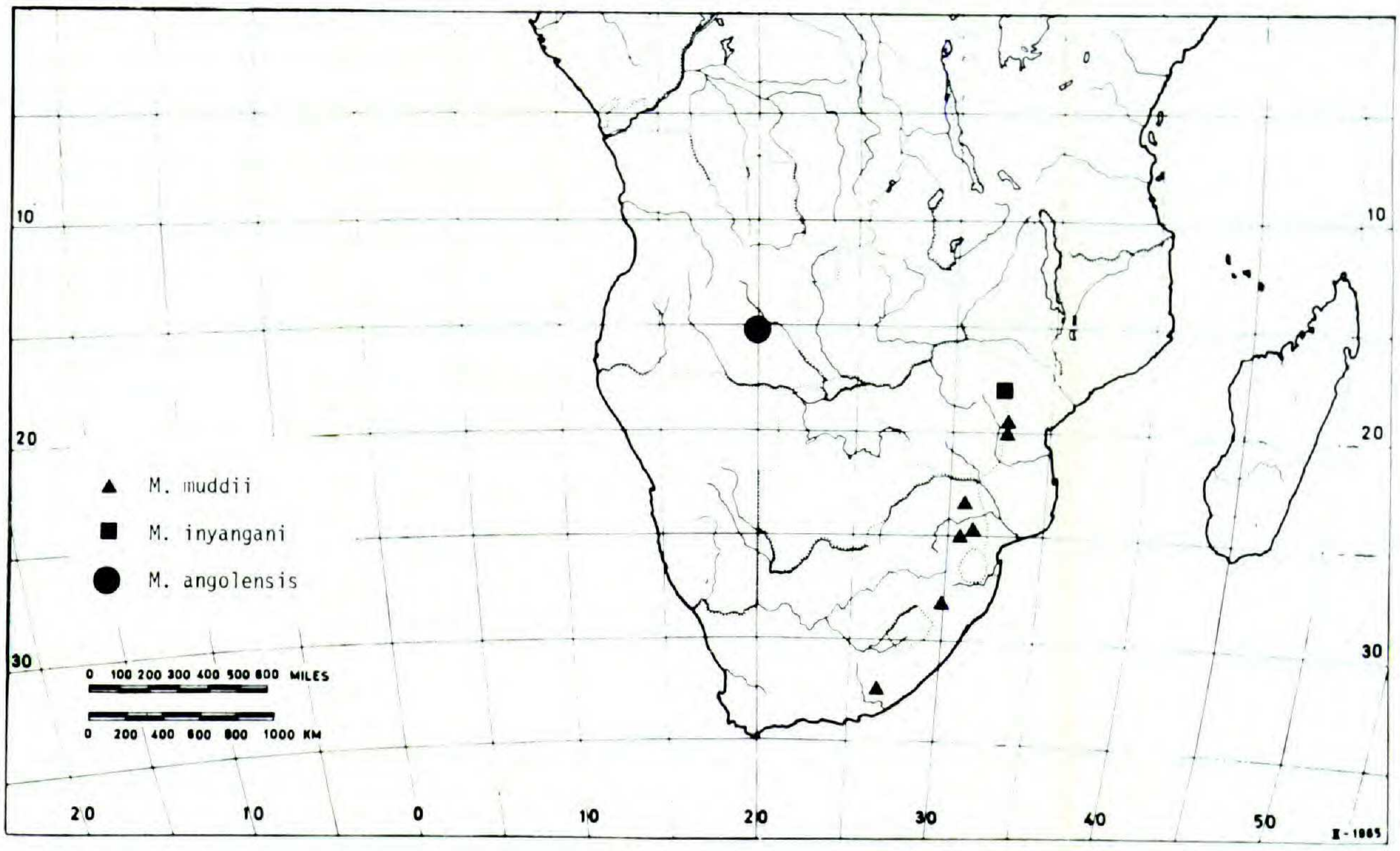

FIGURE 9. Distribution of *Moraea muddii*, *M. inyangani*, and *M. angolensis*.

long. *Ovary* ca. 1.4 cm long; style branches 8–9 mm long, the crests 4–8 mm long. *Capsule* and *seeds* unknown. Chromosome number not known.

Flowering time: September to October (also in April).

Distribution: Rhodesia, endemic on Mount Inyangani, Inyanga district, in moist situations at high altitudes.—FIG. 9.

The distive, small-flowered *Moraea inyangani* appears to be a very local species, having been recorded only from the higher altitudes of Mount Inyangani, in the Inyanga Highlands of Rhodesia. It is most closely related to *M. muddii*, which occurs to the south on the Chimanimani mountains of Rhodesia and Mozambique and in South Africa. *Moraea muddii* has a larger flower and a canaliculate leaf in contrast to the subterete leaf of *M. inyangani*. Both species appear to occupy the same habitat, high altitude grassland in moist situations, and both flower early in spring.

RHODESIA. EASTERN REGION: Inyanga district, Mt. Inyangani, *Leech 8140* (SRGH); *Corby 808* (K, SRGH). Summit ridge of Inyangani, damp flush, *Drummond & Robson 5830* (K, PRE, SRGH). Inyangani, wet flush below summit, *Boughey 264* (SRGH). Vlei on Mt. Inyangani, *Wild 5519* (K, LISC, M, PRE, SRGH); *Burrows 570* (SRGH).

12. **Moraea angolensis** Goldbl., sp. nov. TYPE: Angola, Moxico, Rio Culiti, *Capello & Ivens 18* (LISU, holotype).

Planta graciles. *Folium* solitarium. *Caulis* 35–40 cm alta, bracteis tria, illa 4–4.5 cm longa. *Spatha* 4–5 cm longa. *Flores* parvi; *tepala exteriora* ca. 3.5 cm longa, ungues ca. 2 cm; *tepala interiora* ca. 3 cm longa. *Filamenta* ad 11 mm longa, libera ad apicem 2 mm; *antherae* 6 mm longae. *Germen* 1–1.2 cm longum; rami styli ca. 8 mm longi; cristae ca. 8 mm longae.

Plants slender, 35–40 cm tall. *Corm* unknown. *Leaf* solitary, basal, ca. 2 mm wide and much exceeding the inflorescence, channeled. *Stem* erect. *Bract leaves*

3, 4–4.5 cm long with dry brown apices. *Spathes* 4–5 cm long, herbaceous, with the upper 5 mm dry and brown; outer spathe about ⅔ as long as the inner. *Flowers* ? yellow; *outer tepals* ca. 3.5 cm long, the claw 2 cm long; *inner tepals* ca. 3 cm long. *Filaments* to 11 mm long, free near the apex for 2 mm; *anthers* 6 mm long. *Ovary* 1–1.2 cm long; style branches ca. 8 mm long, the crests to 8 mm long. *Capsule* and *seeds* unknown. Chromosome number unknown.

Flowering time: August.

Distribution: Plains of southeastern Angola.—FIG. 9.

It is with some hesitation that I describe this species as it is based on two very poorly preserved specimens. The holotype and only gathering was collected by Capello and Ivens in August 1885 on their expedition across Africa from Angola to Mozambique. Dr. I. Melo of the University of Lisbon and Dr. E. Mendes, Director of the Junta de Investigacoes do Ultramar, Lisbon, Portugal have kindly aided me in localizing the place of collection, Rio Culiti, as southeastern Angola between latitude 14°50′S and 15°50′S and longitude 19°20′E and 21°50′ E. No other species of *Moraea* are known from anywhere near this area. The plants are quite different from any other tropical African species, perhaps most resembling *M. muddii* and *M. inyangani* both from the highlands of southeast Africa. The slender form, very short bracts and spathes, combined with a small flower make it easily distinguishable from these.

ANGOLA: MOXICO, Rio Culiti, *Capello & Ivens 18* (LISU).

13. **Moraea bella** Harms, Bot. Jahrb. Syst. 28: 364. 1901. TYPE: Tanzania, Southern Highlands, Uhehe, *Goetze 698* (B, holotype).—FIG. 10.

Plants solitary, slender, (30–)40–60(–70) cm high, very rarely branched. *Corm* ca. 1.5 cm in diameter; tunics of pale medium to coarse reticulate fibers. *Prophylls* small, light brown, dry and irregularly broken. *Leaf* solitary, canaliculate, 2.5–6 mm wide, inserted at ground level, and exceeding the inflorescence. *Stem* slender. *Bract leaves* 2–4, widely spaced, 6–7 cm long. *Spathes* dry and brown in the upper part or entirely so; inner spathe 6–10 cm long, the outer ½ to ⅓ the length of the inner. *Flowers* pale yellow, with a darker nectar guide and often conspicuously veined and spotted; outer tepals 4.5–5.5(–6.5) cm long, the limb 2.5–4 cm, spreading; *inner tepals* 3.5–5(–6) cm long, erect. *Filaments* 9–14 mm long, free in the upper third; *anthers* 8–10 mm long. *Ovary* 1.5–2 cm long; style branches 1.3–1.6 cm, the crests 0.8–1.5 cm long. *Capsule* ovate-oblong, 2–3 cm long; *seeds* flattened, ± triangular to discoid. Chromosome number not known.

Flowering time: (Late February) March to June (July).

Distribution: Northern Mozambique, Tanzania, Malawi, Zambia, Zaïre; only in seasonally or permanently waterlogged habitats such as marshes, vleis, dambos; flowering towards the end of the wet season and in the dry season.—FIG. 10.

Moraea bella can readily be recognized by the combination of several morphological features and its moist habitat and late flowering. It is a slender plant

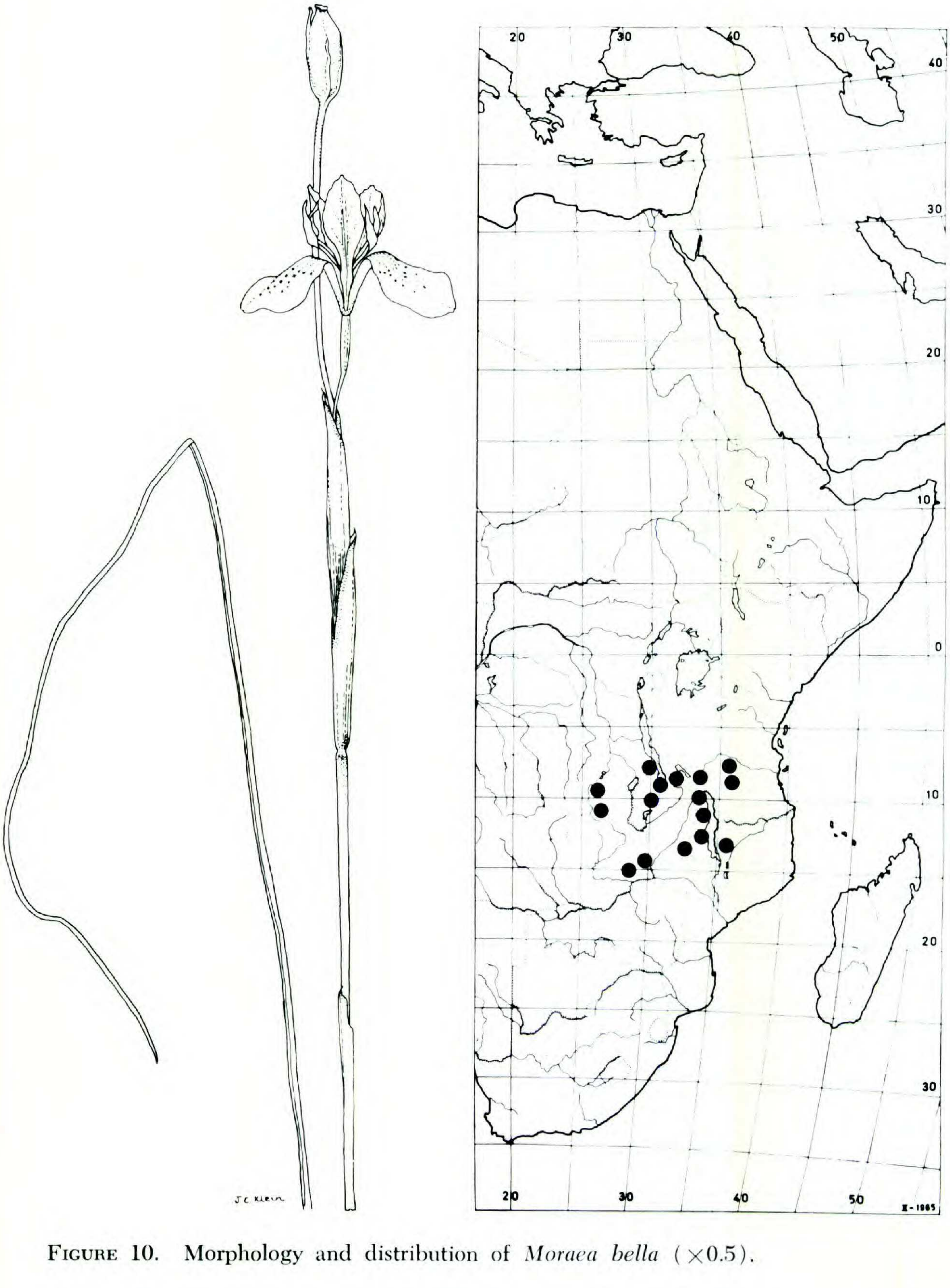

FIGURE 10. Morphology and distribution of *Moraea bella* (×0.5).

with a long, narrow leaf, and 2–4 comparatively short, widely spaced bract leaves. The yellow flowers, which are sometimes characteristically speckled, appear from late February through the end of the wet season and well into the dry season in July. The peak flowering period for the species is in April. *Moraea bella* is almost invariably found in very wet situations, usually in dambos but

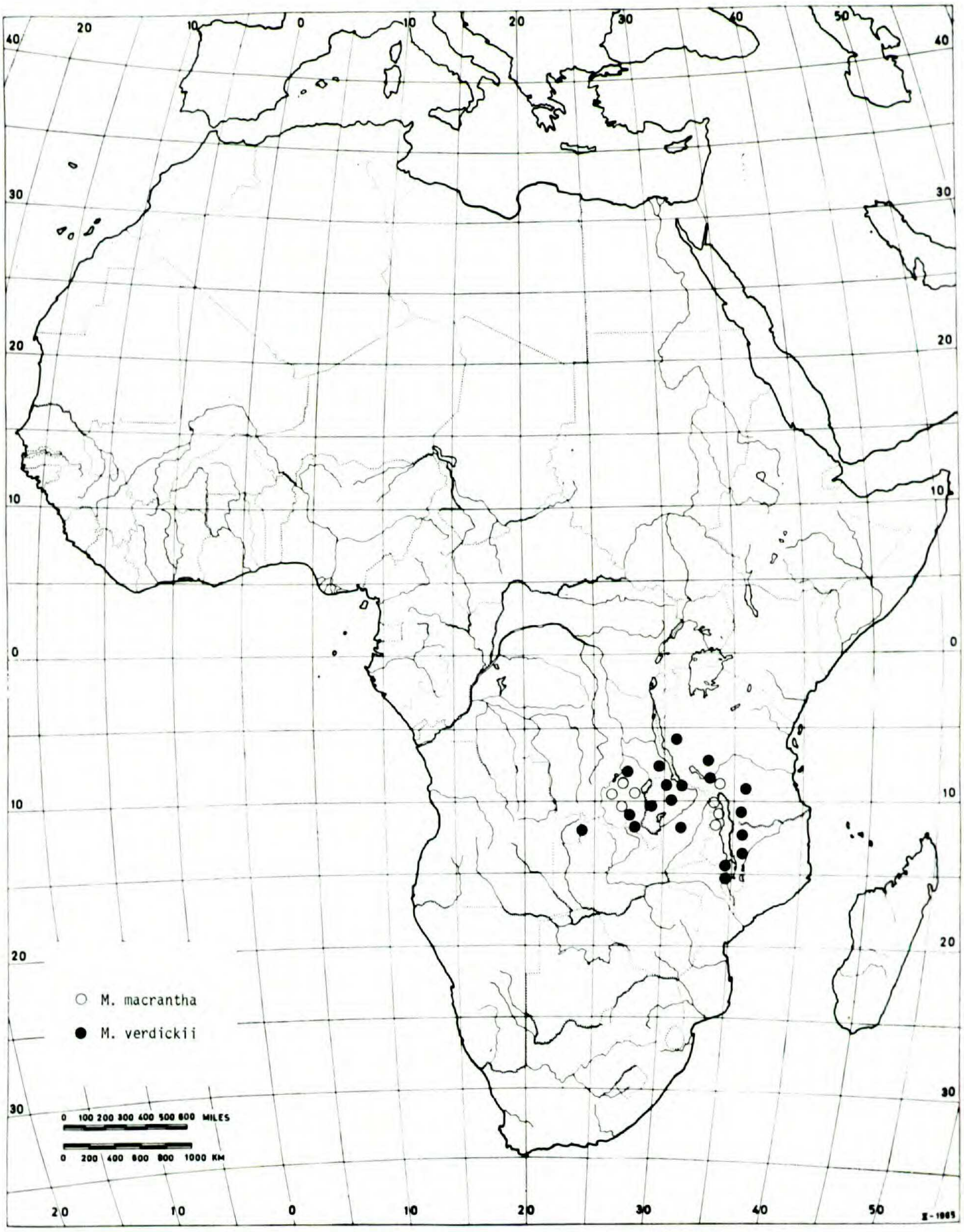

FIGURE 11. Distribution of *Moraea verdickii* and *M. macrantha*.

on occasion simply in damp, poorly drained grassland which retains moisture well after the rains are over.

Though described early this century, the name *M. bella* has been until now overlooked. Plants belonging to this species have either been assigned to *M. angusta*, a common and quite unrelated Cape species, or were included in other species, as for example by Geerinck (1970) who included specimens of *M. bella* in his very broad concept of *M. textilis*. *Moraea bella* is closely related to *M. verdickii*, a larger-flowered species with the same general range and to the *M. macrantha-ventricosa-textilis* complex of south central Africa.

MALAWI. NORTHERN REGION: Mzimba, *Benson 1195* (K), *1339* (BM). Malembo, Mzimba district, *Pawek 8460* (K, MO, SRGH). Fort Hill, *Whyte s.n.* (K). Near Fort Hill, *Pole Evans & Erens 705* (BR, K, PRE, SRGH). Chelinda bridge, Rumphi district, *Pawek 2196* (K). CENTRAL REGION: Mchinji district, *Brummitt 10206* (K). Kasungu Game Reserve, *Brummitt 11603* (K); *Hill-Martin 1776* (PRE, SRGH). 22 km S of Kasungu, *Moriarty 355* (MAL).

MOZAMBIQUE. NIASSA: Vila Cabral, *Pedro & Pedrogao 3629* (EAH).

TANZANIA. SOUTHERN HIGHLANDS: Iringa, *Lynes 269* (K); *Pedersen 990* (DSM); *van Rensburg 677* (K). Between Iringa and Dabaga, *Eggeling 6122* (BR, EAH, K). Lunzua Agricultural Station, marsh, *Richards 5173* (BR). WESTERN PROVINCE: 65 km S of Sumbawanga, *Leach & Brunton 10072* (K, LISC, SRGH). Ufipa district, Isopa, *Robertson 641* (K, WAG).

ZAÏRE. SHABA: Near Kapona, Plateau des Muhila, *Schmitz 1652* (BR). Marungu-Katomia, *van den Bromde 1* (BR). Jadotville, vallée de la Mulende, *Dubois 1274* (K), *1074* (WAG). Kankela Valley, Manika Plateau, *Malaisse 8564* (BR).

ZAMBIA. EASTERN REGION: Chipata (Fort Jameson) *Fanshawe 4501* (EAH, K, SRGH); *van Rensburg 2111* (K, SRGH); *Munch 459* (K, LISC, SRGH). Lundazi, *Fanshawe 9291* (K, SRGH). Lukusuzi Game Reserve, *Sayer 205* (SRGH). CENTRAL REGION: Chakwenga headwaters, E of Lusaka, *Robinson 6473* (K, SRGH). Kawambura, *Fanshawe 3674* (K). Between Undaunda and Rufunsa, *Kornas 1519* (K). NORTHERN REGION: N of Mbala (Abercorn), *Greenway 6219* (K, EAH, PRE). "Fwambo," *Nutt s.n.* (K); *Carson s.n.* (K). Mbala district, Kawimbe road, *Richards 21407* (K, MO); *Sanane 1225* (K, PRE); *Robertson 618* (EAH, K); *Richards 897* (K), *1367* (K). Kambole escarpment, *Richards 9989* (K). Chisinga Ranch near Luwingu, *Astle 524* (K, SRGH), *3017* (SRGH).

14. **Moraea verdickii** De Wild., Ann. Mus. Congo, Sér. 4, Bot. 1: 17. 1902. TYPE: Zaïre, Shaba, Lukafu, *Verdick 281* (BR, holotype).—FIG. 12A.

Plants large, 45–75 cm high, unbranched. *Corm* ca. 2 cm in diameter; tunics coarse, of pale or occasionally dark fibers. *Prophylls* pale to dark brown, dry, broken and fibrous apically. *Leaf* linear, shortly exceeding the inflorescence, canaliculate or ± flat, 4–12 mm wide, inserted near the base but often up to 10 cm above ground. *Stem* bearing 2–3(–4) herbaceous bract leaves, usually widely spaced but occasionally overlapping. *Spathes* herbaceous, with a brown, acute apex; inner spathe 9–15 cm long, the outer ca. ⅔ the inner. *Flowers* yellow; *outer tepals* (5–)6–7.5(–10) cm long, the limb 3–5 cm long, spreading; *inner tepals* erect, 4.5–7 cm long. *Filaments* 11–16 mm long, free in the upper third; *anthers* (10–)11–14 mm long. *Ovary* usually exserted, 1.5–2(–2.5) cm long; style branches 1.7–2.5 cm long, the crests 1–1.7 cm long. *Capsule* and *seeds* not known. Chromosome number not known.

Flowering time: Late November to February (March).

Distribution: Grasslands and open bush, occasionally in damper situations, in eastern Angola, northern and western Zambia, Zaïre, Tanzania, Malawi, and central Mozambique.—FIG. 11.

Moraea verdickii is one of the taller species of *Moraea* and has particularly large flowers. It occurs in a belt across south tropical Africa from eastern Angola through southern Zaïre and Zambia to Malawi, southwestern Tanzania and Mozambique. Though recognized as early as 1902 by De Wildeman, it has in the past been included in *M. ventricosa* in herbaria, and most recently was in-

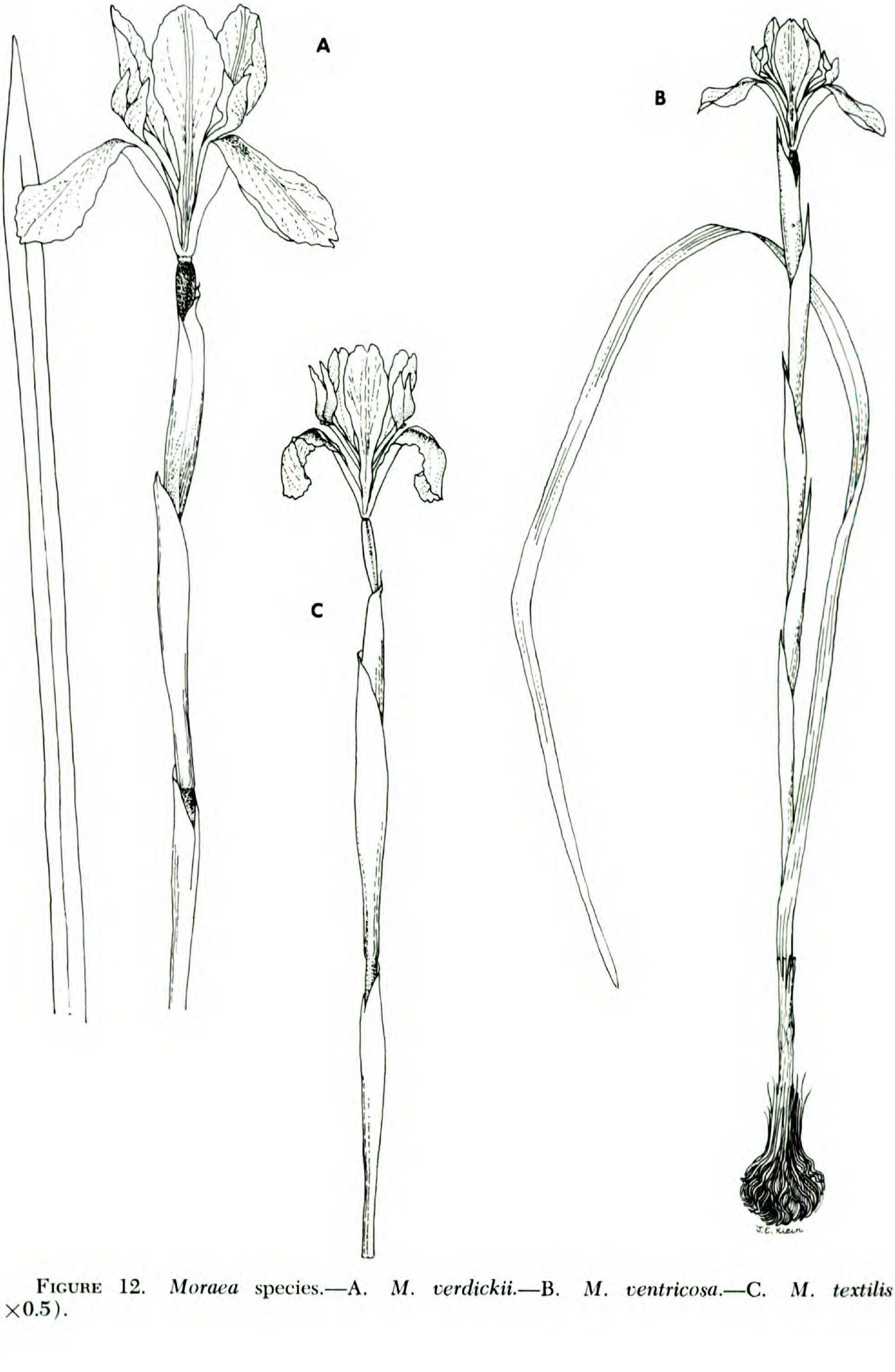

FIGURE 12. *Moraea* species.—A. *M. verdickii.*—B. *M. ventricosa.*—C. *M. textilis* (×0.5).

cluded with *M. ventricosa* in *M. textilis* by Geerinck (1970) who held a very broad concept of this species.

A detailed and critical comparison of a large number of specimens of *M. verdickii* and its close allies, *M. ventricosa*, *M. textilis*, and also including the related *M. macrantha* was made in the course of this study. In my estimation the best solution to the systematics of this group is to recognize all four species. *Moraea verdickii* can be distinguished from its close allies by its large, consistently yellow flower, with the outer tepals ranging from (5–)6–10 cm long and the anthers (10–)11–14 mm long; few bract leaves, generally 2 or 3; its habitat, grassland and open bush; and its early flowering, from late November to February, occasionally until March. *Moraea macrantha* has similar large flowers which are always dark blue, has 4–5 bract leaves, and flowers later, from mid February to July. *Moraea ventricosa* has smaller, blue or white flowers, 3–6 bract leaves, often grows in wet situations, and flowers from February to May; while *M. textilis*, with either yellow or blue flowers, generally has 5–7 bract leaves, and reaches peak flowering in May.

ANGOLA. MOXICO: Lusavo falls, *Milne-Redhead 4088* (BR, K).

MALAWI. CENTRAL PROVINCE: Dedza, *Jeke 79* (K, SRGH). Chongoni forest, Dedza, *Banda 526* (SRGH); *Salubeni 1253* (K, MAL, SRGH). Dedza mountain area, *Adlard & Chapman 561* (K, LISC, SRGH). Kirk Range, Ncheu-Neno road, *Robson 1404A* (K, LISC, SRGH).

MOZAMBIQUE. NIASSA: 80 km from Mijjao de Massangulo to Vila Cabral, *Correia 154* (LISC). Near Mtengula, *Seddon 7* (K). TETE: 8 km from Mlangeni, on Ncheu-Dedza road, *Brummitt 8609* (K, SRGH). Kirk Range, Ncheu-Neno road, *Robson 1404* (K). Massangulo, *Gomes & Sousa 1306* (K). ZAMBEZIA: Grirué near Vila Quanquiero, *Torre 5078* (LISC).

TANZANIA. SOUTHERN HIGHLANDS: Iringa district, 25 km S of Dabaga, *Polhill & Paulo 1560* (BR, EAH, K, LISC, PRE). 50 km N of Mbeya, *Bally & Carter 16475* (EAH, SRGH). Ca. 120 km N of Mbeya on Itigi road, *Boaler 843* (K). SOUTHERN PROVINCE: Matengo hills, Songea, *Milne-Redhead & Taylor 9024* (LISC, PRE, SRGH).

ZAÏRE. SHABA: SE Lubumbashi (Elisabethville), *Schmitz 3721* (BR). Near Lubumbashi, *Hirschberg 58* (PRE). Keyberg, *Schmitz 1230* (BR). Derubo, *Quarré 1008* (BR). Marie José, *Quarré 1524* (BR). Lupaku River, *Kassner 2466* (BR, K, Z). Marungu, Kisinde, *Dubois 1074* (BR, WAG). Mitwaba terr. River Kenia, *de Witte 2470* (K, SRGH).

ZAMBIA. NORTHERN PROVINCE: Kambole escarpment, *Richards 18881* (K, UPS). Itembwe Gorge, Mbala (Abercorn) district, *Richards 12055* (EAH, K, MO, SRGH). Itembwe Gap, *Richards 18830* (K, SRGH). Mbala, Kalambo falls road, *Richards 17080* (K, SRGH); *Bullock s.n.* (BR, K). Mpika, *Fanshawe 1890* (BR, K, SRGH). 40 km N of Mpika, *Williamson 1470* (K, SRGH). S of Nchelenga, Kawambwa district, *Williamson 1233* (SRGH). Chishinga ranch, *Astle 1395* (SRGH). WESTERN PROVINCE: Matonchi farm, Mwinilunga district, *Milne-Redhead 3930* (BR, K, LISC, PRE).

15. **Moraea macrantha** Baker, Fl. Trop. Africa 7: 340. 1898. TYPE: Malawi, Northern Province, without precise locality, *Whyte s.n.* (K, holotype).

M. arnoldiana De Wild., Ann. Mus. Congo, Sér. 4, Bot. 1: 16. 1902. TYPE: Zaïre, Shaba, Kasenga, Lukafu, *Verdick 606* (BR, holotype).

Plants solitary, unbranched, 50–70 cm high. *Corm* ca. 1.5 cm in diameter; tunics of pale fine to medium fibers. *Prophylls* brown, soft textured and irregularly broken to fibrous. *Leaf* solitary, linear, basal, canaliculate, to 7 mm wide, much exceeding the inflorescence. *Stem* unbranched. *Bract leaves* 4–5, herbaceous, usually overlapping, attenuate, 6–10 cm long. *Spathes* herbaceous, with a dry acute apex; inner spathe 9–13 cm long, the outer ca. ⅔ the inner.

Flowers blue violet with pale nectar guides; *outer tepals* (5.7–)6.5–8 cm long, the limb ± equal or exceeding the claw, 3.0–4.5 cm long; *inner tepals* 5.5–7.5 cm long, lanceolate. *Filaments* 1.3–1.7 cm long, free in the upper half to third; *anthers* 1.2–1.5 cm long. *Ovary* ca. 2 cm long, often enclosed in the spathes; style branches ca. 2.5 cm long, the crests to 2 cm. *Capsule* ca. 3 cm long; *seeds* flattened, ± triangular. Chromosome number $2n = 12$.

Flowering time: (Mid February) March to early July.

Distribution: Open woodland or montane grassland in northern Malawi, eastern Zambia, southwestern Tanzania, and Zaïre.—FIG. 11.

Moraea macrantha is closely related to *M. verdickii* and *M. textilis* (see discussion under *M. verdickii*). It can be distinguished from *M. verdickii* by its dark blue flowers, 3–5 bract leaves, and later flowering, from mid February to July; and from *M. textilis* by its generally larger flowers, with tepals in the 5.7–8 cm range, and anthers 1.2–1.5 cm long.

Moraea macrantha is apparently common in northern Malawi and relatively rare elsewhere, though it extends through southwestern Tanzania to the higher areas of Shaba in Zaïre. It occurs only in highland areas and flowers from mid- to late-wet season.

MALAWI. NORTHERN REGION: Vipya hills, *Chapman H 640* (SRGH). Vipya plateau, *Salubeni 660* (K, LISC, PRE, SRGH). Vipya link road, *Pawek 1060* (K, MAL, SRGH). Vipya, Luwawa, *Chapman 1632* (K, SRGH). Mzuzu, *Pawek 5396* (K, MO, SRGH), *5832* (MO, SRGH), *2448* (K, MAL). Mzimba district, *Jackson 1283* (BM, BR, K, MAL). Rumphi district, *Pawek 3595* (K, MAL). Nyika Plateau, *Pawek 6696* (MO, PRE). Chitipa, between Misuku hills and Kalenje River, *Pawek 5170* (K, MAL, MO, SRGH). 30 km S of Chikangawa, Vipya Mts., *Brummitt 10470* (K). Wenya, *Benson 1325* (BM). Mafinga Mts. near Chisengo, *Chapman 1864* (SRGH).

TANZANIA. SOUTHERN HIGHLANDS: Ulanda, Ulambya, *Leedal 599* (EAH). Kasebe, Bundali, *Leedal 439* (EAH).

ZAÏRE. SHABA: Lukafu, Mutoli-Tuli, *Verdick s.n.* (BR). Parc Nationale de l'Upemba, Pandeluru, *de Witte 2611* (BR). Plateau des Kundulungu, *Lisowski, Malaisse & Symoens 11621* (BR). Kibura Plateau, 25 km N of Mitwaba, *Lisowski, Malaisse & Symoens 13676* (BR). 5 km S of Poste de Katshupa, *Lisowski, Malaisse & Symoens 5798* (BR).

ZAMBIA. EASTERN PROVINCE. Nyika Plateau, *Richards 14388* (K).

16. **Moraea ventricosa** Baker, Bull. Misc. Inform. 1895: 13. 1895. TYPE: Zambia, Northern Province, "Fwambo," *Carson 37/1894* (K, holotype).—FIG. 12B.

M. bequaertii De Wild., Repert. Spec. Nov. Regni Veg. 11: 540. 1913. TYPES: Zaïre, Shaba (Katanga), Lubumbashi, *Bequaert 316* (B, lectotype). Zaïre, Tshisenda, *Ringoet 419* (BR, syntype); *Homblé 360* (BR, syntype). Zaïre, Lubumbashi, *Homblé 238* (BR, syntype).

Plants medium, 30–45 cm high, unbranched. *Corm* ca. 1.5 cm in diameter; tunics of pale medium to fine fibers. *Prophylls* pale to dark brown, broken and becoming fibrous. *Leaf* exceeding the inflorescence, linear, canaliculate, 3–7 mm wide. *Stem* bearing 3–5(–6) overlapping, herbaceous bracts. *Spathes* herbaceous; inner spathe 8–11.5(–13.5) cm long, the outer ca. ⅔ the inner. *Flowers* comparatively small, blue purple or white to pale yellow; *outer tepals* 4–5(–5.5) cm long, the limb equal or slightly shorter than the claw; *inner tepals* 3.7–4.5 cm long. *Filaments* 12–15 mm long, free in the upper third; *anthers* 8–10(–11) mm long. *Ovary* ca. 2 cm long; style branches 1.4–1.7 cm long, the crests ca. 1

cm long. *Capsule* ovoid, to 3 cm long; *seeds* not known. Chromosome number $2n = 12$.

Flowering time: Late February to early May (one record from September).

Distribution: Burundi, western and southern Tanzania, southeastern Zaïre, and northern and western Zambia; open woodland or grassland, often in moister places along the margins of dambos, marshes, etc.—FIG. 13.

Moraea ventricosa as treated here includes both white (to pale yellow) and blue, small-flowered plants. It is one of the few species of subgenus *Grandiflora* where forms with different colored flowers are known. White-flowered plants occur in the eastern part of its range in western Tanzania, Burundi, and northeastern Zambia, while blue-flowered plants predominate to the west, in Zaïre and northwestern Zambia, *M. bequaertii* from Zaïre exemplifying the latter. Though recorded from open woodland or grassland, *M. ventricosa* is more often found in moist situations as along dambo margins or poorly drained areas.

As discussed under *M. verdickii*, *M. ventricosa* is part of a complex of closely allied species including *M. macrantha* and *M. textilis*. In fact, it appears most closely related to the Angolan *M. textilis* which generally has larger flowers, with outer tepals in the 5–6 cm range and anthers 10–13.5 mm long. Specimens of *M. verdickii* have in the past usually been included in *M. ventricosa*, but the larger yellow flowers of the former, as well as its earlier blooming habit, should be sufficient to prevent confusion.

BURUNDI. Gitega, Burasira, *Lewalle 1728* (BR, K, WAG). Vicinity of Karuzi-Bureru, *van der Ben 1966* (K).

TANZANIA. SOUTHERN HIGHLANDS: Mtengulu, Kyimbila district, *Stolz 2625* (BM, BR, K, PRE). Elton Plateau, S of Chimala, *Milton 72* (EAH). Tunduma, *Moreau & Moreau 9807* (EAH). Tunduma-Sumbawanga, *Leedal 1076* (EAH). WESTERN PROVINCE: Ufipa district, vlei near Zambia border, *Whellan 1212* (K, MAL, SRGH). Near Chapota, Sumbawanga, *Richards 8507* (K). Lake Kwela, *Bullock 2650* (K). Kundi, *Bullock s.n.* (K).

ZAÏRE. SHABA: Lubumbashi (Elisabethville), Boitsfort, *Robyns 1655* (BR, EAH, WAG). Lubumbashi, *Bequaert 316* (BR); *Hirschberg 58* (K). Vallée de Lubumbashi, *Quarré 3179* (BR, WAG). Kipopo, *Thoen 4646* (BR); *Schmitz 5835* (BR). Lopoto, *Schmitz 4855* (BR). Kafubu, *Quarré 182* (BR, WAG). Vallée de Kapiri, *Homblé 1238* (BR). Tshinsinka, Manika (Biano) Plateau, *Homblé 1275* (BR).

ZAMBIA. NORTHERN PROVINCE: Mbala (Abercorn) district, Lumi River Marsh, *Richards 12278* (SRGH). Kawimbe, *Richards 8329* (K), *19038* (K, MO). Kali, dambo, *Richards 4976* (K). WESTERN PROVINCE: Solwezi, *Drummond & Rutherford-Smith 7031* (BR, K, LISC, M, PRE, SRGH). Ndola, *Fanshawe 969* (BR, EAH, K, SRGH). Kitwe, *Fanshawe 10142* (SRGH); *Mutimushi 267* (SRGH), *2546* (K). Mutufa River, *Lawton 237* (K). Shibuchinga, *Fanshawe 8388* (K, SRGH). Mwinilunga district, *Marks 42* (K). Kabompo road, 25 km from Mwinilunga, *Edwards 676* (LISC, PRE, SRGH).

17. **Moraea textilis** Baker, Trans. Linn. Soc., London Bot., Ser. 2, 1: 270. 1878. TYPE: Angola, Huila, Lopollo River, flowering in April, *Welwitsch 1549* (BM, holotype; COI, K, LISU, isotypes).—FIG. 12C.

M. mechowii Pax, Bot. Jahrb. Syst. 15: 151. 1893. TYPE: Angola, Catala Canginga, flowering in Feb., *Teuscz in Exped. Mechow 557c* (B, holotype; BM, isotype).

Plants large, 40–80 cm high, unbranched. *Corm* ca. 2 cm in diameter; tunics of coarse, grey, wiry fibers. *Prophylls* rigid, pale, streaked with longitudinal dark veins and irregularly broken. *Leaf* linear, canaliculate, exceeding the in-

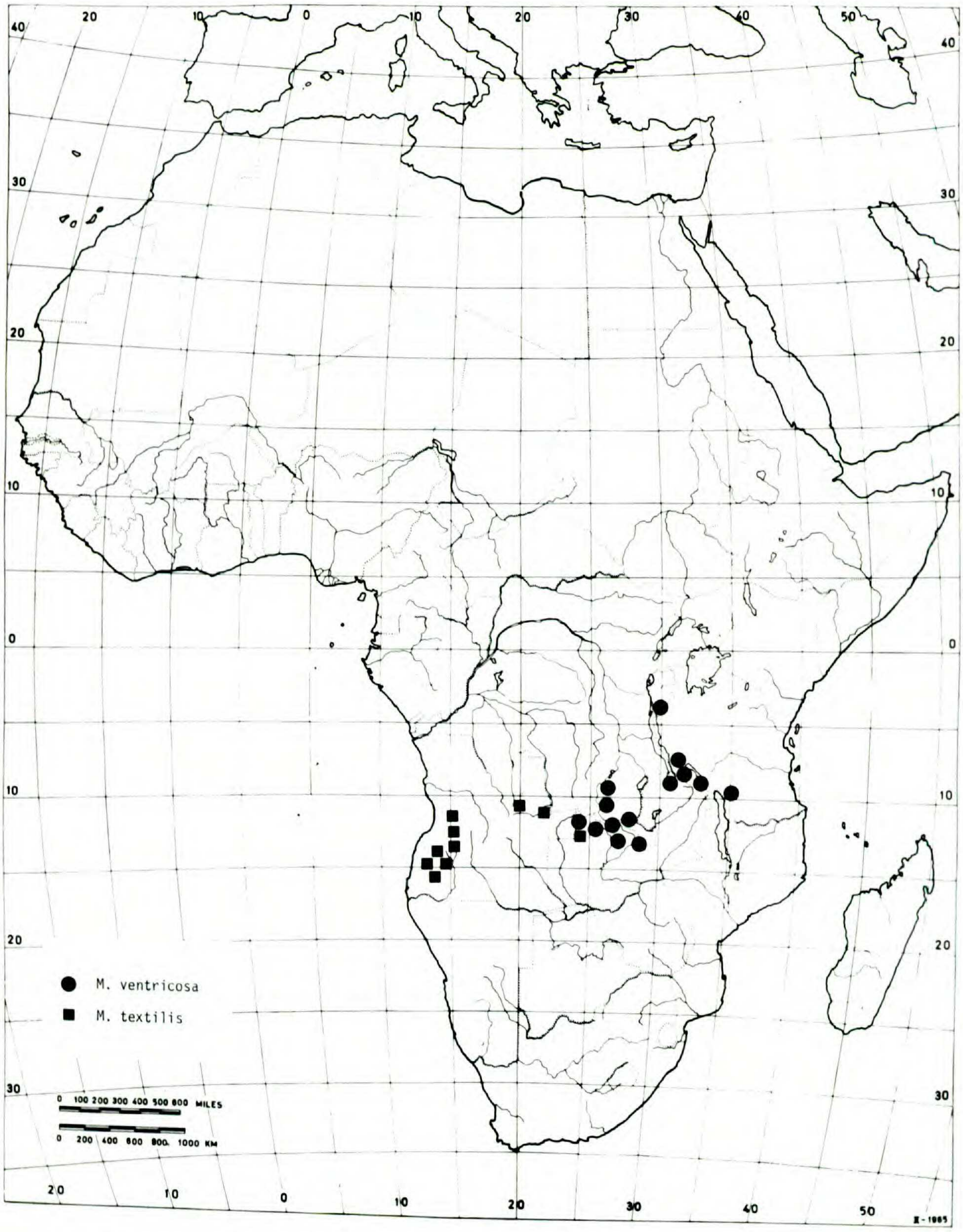

FIGURE 13. Distribution of *Moraea ventricosa* and *M. textilis*.

florescence, 6–8 mm wide. *Stem* bearing (3–)5–7, often dry and usually overlapping, bract leaves. *Spathes* herbaceous, becoming dry from above, acute, often becoming reddish; inner spathe 8–15 cm long, the outer ca. ¾ the inner. *Flowers* blue purple or yellow, usually conspicuously streaked with purple; *outer tepals* 4.7–6.3 cm long, the claw often slightly exceeding the limb; *inner tepals* erect, 4.8–6.5 cm long. *Filaments* 1.5–2.2 cm long, free in the upper quarter; *anthers* 1.0–1.35 cm long. *Ovary* ca. 2 cm long; style branches 1.5–2.5 cm long, the crests to 1.5 cm long. *Capsule* ovoid, ca. 3 cm long; *seeds* flattened and triangular to discoid. Chromosome number not known.

Flowering time: (January) April to June (July to August).

Distribution: Throughout the Angolan plateau above 1,200 m in grassland or rocky sites, occasionally reported from damper situations.—Fig. 13.

A much more restricted concept of *M. textilis* is proposed here compared to Geerinck's (1970) treatment of this species which included *M. ventricosa* and *M. verdickii.* As treated here, *M. textilis* occurs almost exclusively in Angola, from the highlands in the southwest to the border of Zaïre and Zambia, one collection being known from western Zambia. Collections suggest that the species is common in the provinces of Huila and Huambo, and relatively rare elsewhere, though this may simply be a reflection of collecting activity being concentrated in population centers. *Moraea textilis* is reported from grassland and rocky sites at elevations above 1,200 m, though occasionally also from damp places. It has a remarkably long flowering period from December to July, though most collections are from the months of May and June, in the dry season.

Moraea textilis is most closely related to *M. ventricosa*, a somewhat smaller species occurring mainly in moist situations to the east, and it is also allied to *M. verdickii* and *M. macrantha* as discussed under *M. verdickii.* The latter invariably has yellow flowers which are larger than those of *M. textilis*, and it blooms in the wet season, from November to February and March.

ANGOLA. BENGUELLA: Highlands between Ganda and Caconda, *Hundt 822* (BM, Z). Bailono district, *Wellman 1906* (K). Caconda, *Gossweiler 4206* (COI). CUANZO SUL: Amboim, *Gossweiler 996K* (COI, K). HUAMBO: Huambo (Nova Lisboa), *da Silva 3604* (LISC). Between Huambo and Quipeio, *Exell & Mendonça 1874* (BM). Near Caululo, *Moreno 163* (COI, LISC). Cuima, *Exell & Mendonça 1937* (BM). Country of the Ganguellas and Ambuellas, *Gossweiler 4136* (K). Sacaala forest, *Murta 170* (COI). Mt. Moco, plateau above village, *Huntley 3430* (PRE). HUILA: Hoque, *Henriques 1020* (BM, COI, K, LISC, LISU, SRGH). Leba, *Pritchard 339* (BM, K, LISC). Near Lopollo River, *Welwitsch 1549* (BM, COI, K, LISU). Turdevala NW of Sa de Bandeira, *Kers 3294* (K, LISC, PRE, S); *Barbosa & Moreno 10218* (COI). Lubango, Buraco do Bimbe, *Mendes 3762* (LISC). Tchivinguiro, *Henriques 59* (LISC). LUNDA: R. Coxi, *Exell & Mendonça 1358* (BM). Xassengue Caiango, near River Cuando, *Gossweiler 11855* (COI). MOXICO: Texeira de Sousa, *Gossweiler 12248, 12249* (BM, LISC).

ZAMBIA. WESTERN PROVINCE: Plaius, Mwinilunga district, *Marks 42* (K).

18. **Moraea tanzanica** Goldbl., sp. nov. TYPE: Tanzania, Southern Highlands, Kyimbila district, *Stolz 2142* (K, holotype; BM, BR, GH, PRE, Z, isotypes). —Fig. 14A.

Planta 20–35 cm alta. *Tunicae* cormi pallidae. *Folium* solitarium, canaliculatum, 15–25 cm longum raro spathas excedentium, insertum breviter supra terram. *Caulis* simplex, ferens bracteis duabus. *Spathae* herbaceae, interior 9–10 cm longa, exterior 6–8 cm longa. *Flores* luteis; *tepala exteriora* 4.5–5.5 cm longa, limbis 3–3.5 cm longis, expansis; *interiora* 3.5–4.5 cm longa. *Filamenta* 1.2–1.5 cm longa; *antherae* ca. 1 cm longae. *Germen* 1.7–2.2 cm longum; rami styli 1.7–2 cm longi; cristae ca. 1.3 cm longae.

Plants solitary, medium, 20–35 cm high. *Corm* ca. 1.5 cm in diameter; tunics of pale medium fibers. *Prophylls* dry-membranous, pale, irregularly torn above. *Leaf* solitary, 15–25 cm long, seldom reaching beyond the midline of the spathes,

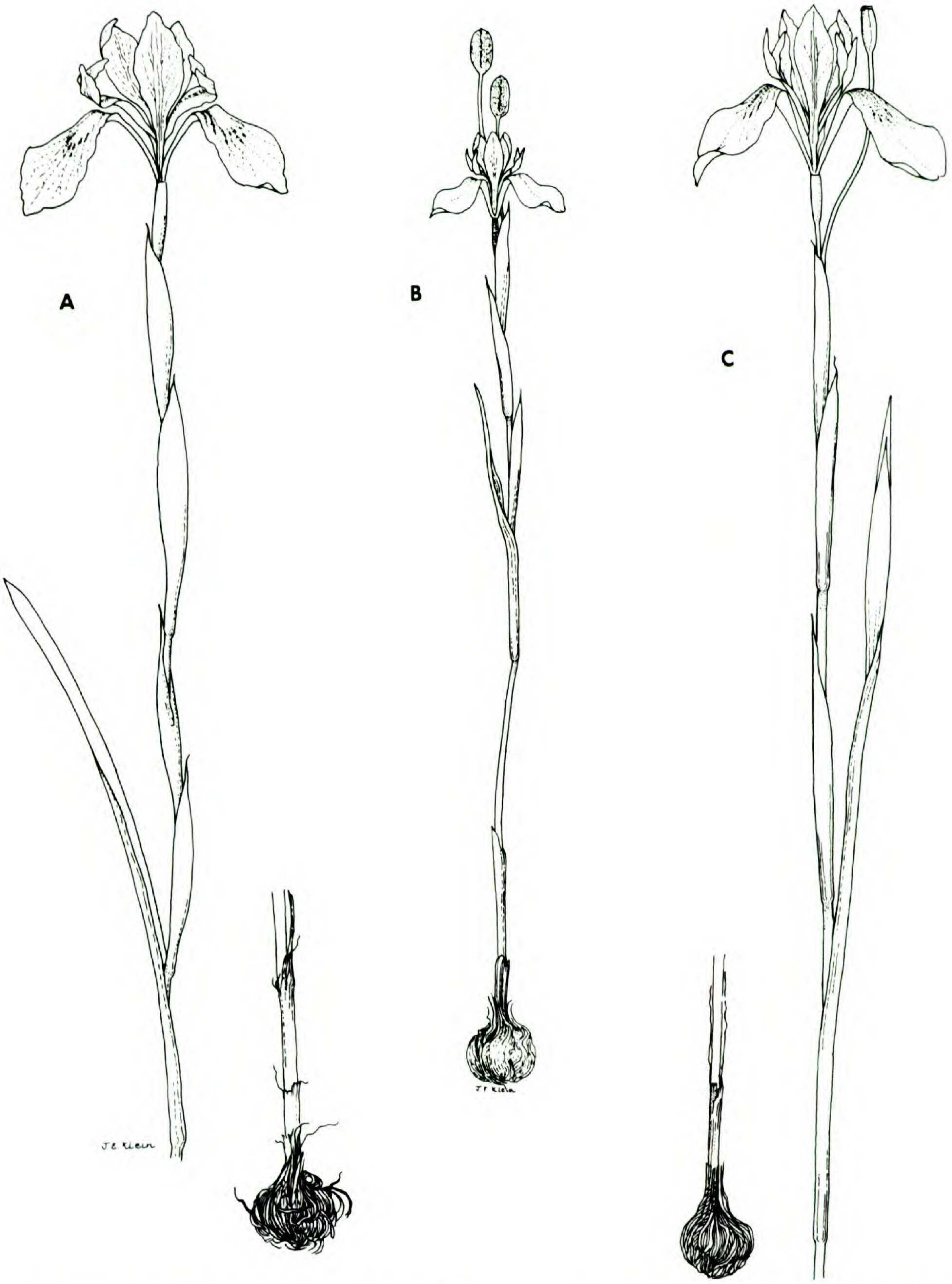

FIGURE 14. *Moraea* species.—A. *M. tanzanica*.—B. *M. clavata*.—C. *M. brevifolia*. (×0.5).

canaliculate, inserted shortly above ground level. *Stem* simple. *Bract leaves* 2, usually overlapping. *Spathes* herbaceous, attenuate; inner spathe 9–10 cm long, the outer ca. ⅔ the inner. *Flowers* yellow; *outer tepals* 4.5–5.5 cm long, the limb 3–3.5 cm long, spreading; *inner tepals* erect, 3.5–4.5 cm long. *Filaments* 1.2–1.5

cm long, free in the upper half; *anthers* ca. 1 cm long. *Ovary* 1.7–2.2 cm long; style branches 1.7–2 cm long, the crests ca. 1.3 cm long. *Capsule* cylindrical, to 3 cm long; *seeds* flattened, discoid. Chromosome number $2n = 12$.

Flowering time: January to March.

Distribution: Northern Malawi and southern Tanzania, at high altitudes, 2,000–3,000 m; in open mountain grassland.—FIG. 15.

Moraea tanzanica is related to the *M. textilis* complex, and particularly to the yellow-flowered *M. verdickii*. It is, however, a much smaller species, though with a very large flower, and can always be distinguished from *M. verdickii* by its consistently short leaf which seldom reaches beyond the midline of the spathes. *Moraea tanzanica* appears to stand at the beginning of a series of reduced species in which the leaf is generally short and inserted above ground level, sometimes at the base of the inflorescence. In this group the bract leaves are often congested and may be reduced in number or even lacking, as in *M. unifoliata*, the most specialized species in this alliance.

The species most closely related to *M. tanzanica* among the reduced species are *M. brevifolia*, which often has a shorter leaf and solitary bract leaf, and *M. clavata*, an early-flowering species with much smaller flowers. *Moraea tanzanica* is confined to southwestern Tanzania where it has been collected mostly at high altitudes in short grassland. It flowers from January to March, particularly towards the end of summer. In contrast, *M. brevifolia*, found to the west in Zambia, blooms in December to January and occurs only in marshy situations. *Moraea clavata*, flowering even earlier in late spring to mid summer, is also confined to moist situations and occurs from central Zambia to southern Angola.

MALAWI. NORTHERN REGION: Nyika Plateau, Katumbi-Juniper forest turnoff, *Pawek 6660* (MO); *Phillips 1071A* (K, MO, SRGH).

TANZANIA. SOUTHERN HIGHLANDS: Kyimbila district, *Stolz 2142* (BM, BR, GH, K, PRE, Z). Elton Plateau, *Richards 14128* (EAH, K). Rungwe Mt., *Richards 14314* (K). Rungwe caldera, *Pocs 6505* (DAR). Mbeya Peak, *Kerfoot 1628* (EAH). Kipengere Mts., Njombe district, *Richards 7574, 7617* (K). Ndumbi Forest Reserve, *Semsei 1664* (EAH, K).

19. **Moraea brevifolia** Goldbl., sp. nov. TYPE: Zambia, Northern Region, Lumangwe Falls, Mporokoso district, *Simon & Williamson 1483* (K, holotype; LISC, SRGH, isotypes).—FIG. 14C.

Plantae 25–50 cm alta. *Tunicae* cormi pallidae, tenues. *Folium* solitarium, breve, 5–20 cm longum, insertum in pars inferior caulis. *Caulis* simplex, ferens bractea una, raro dua. *Spathae* herbaceae, interior 7.5–12 cm longa, exterior 6–9 cm longa. *Flores* luteus; *tepala exteriora* 5–7 cm longa, limbis 3–4 cm longis, expansis; *interiora* 4–5 cm longa. *Filamenta* 10–12 mm longa; *antherae* 9–16 mm longae. *Germen* 1–1.3 cm longum; rami styli 1.2–2.5 cm longi; cristae ad 1.5 cm longas.

Plants 25–50 cm high, solitary. *Corm* 1–1.5 cm in diameter; tunics of fine brown reticulate fibers. *Prophylls* dry-membranous, becoming lacerated above. *Leaf* solitary, short, 5–20 cm long, with a free apex or entirely sheathing and bractlike, inserted in the lower half of the stem, above ground level, canaliculate. *Stem* simple. *Bract leaf* 1 (occasionally 2), 6–9 cm long. *Spathes* herbaceous, with brown attenuate apices; inner spathe 7.5–12 cm long, the outer ca. ½–⅔ the inner. *Flowers* yellow; *outer tepals* 5–7 cm long, the limb 3–4 cm long, spread-

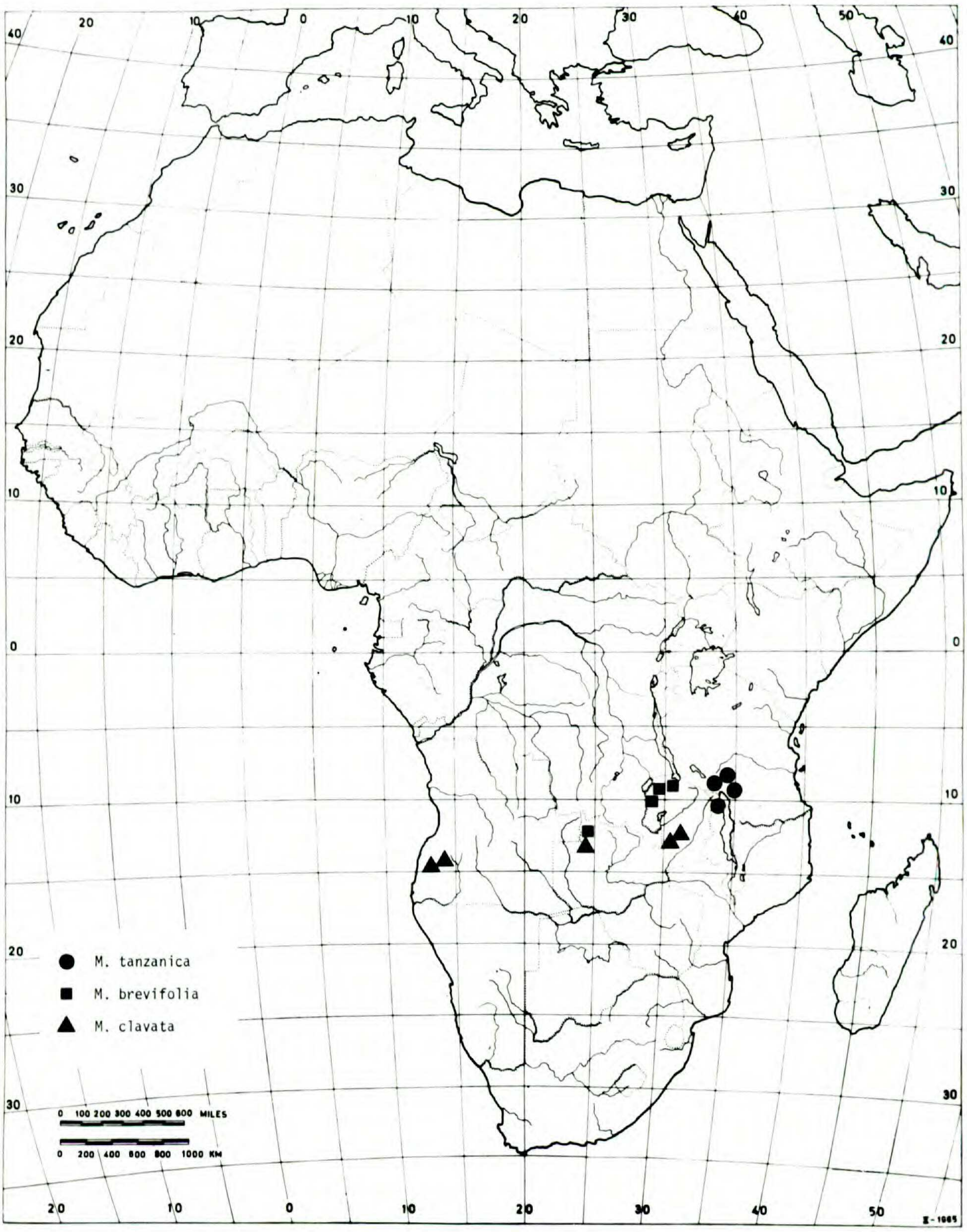

FIGURE 15. Distribution of *Moraea tanzanica*, *M. brevifolia*, and *M. clavata*.

ing; *inner tepals* erect, 4–5 cm long. *Filaments* 10–12 mm long, free in the upper third; *anthers* 9–16 mm long. *Ovary* 1–1.3 cm long; style branches 1.2–2.5 cm long, the crests to 1.5 cm long. *Capsule* and *seeds* unknown. Chromosome number not known.

Flowering time: December to January.

Distribution: Zambia, central to northeastern Zambia; in wet places.—FIG. 15.

Moraea brevifolia is apparently rare and occurs only in marshy situations in northern and western Zambia where it blooms in midsummer. It is somewhat variable in leaf morphology, some plants having a very short, almost entirely sheathing leaf, while in others the leaf is longer with the free portion reaching the spathes. The leaf is, however, distinctive in its point of insertion, well above ground, at about the midline of the stem. *Moraea brevifolia* is closely related to the predominantly Angolan *M. clavata*, a generally smaller species, which consistently has smaller flowers. *Moraea brevifolia* may also be confused with *M. tanzanica*, which has similar flowers, but is vegetatively more robust, has a larger broader leaf, and always has two bract leaves where one is the rule in *M. brevifolia.* These two species also differ in habitat and time of flowering, *M. tanzanica* being found in montane grassland and flowering later in the summer than *M. brevifolia.*

ZAMBIA. NORTHERN PROVINCE: Lumangwe Falls, Mporokoso district, *Simon & Williamson 1483* (K, LISC, SRGH). N'chelengi-Luapula River road, Kawambwa district, *Richards 15476* (K). Kambole-Mbala road, *Richards 11901* (K). Chinakila-Loye flats, Mbala district, *Richards 19473* (K). WESTERN REGION: Mwinilunga district, *Milne-Redhead 3930* (BM, BR, LISC). Plauis, Mwinilunga district, *Marks 41* (K).

20. **Moraea clavata** Foster, Contr. Gray Herb. 114: 49. 1936. TYPE: as for *M. gracilis* Baker.—FIG. 14B.

M. gracilis Baker, Trans. Linn. Soc. London, Bot., Ser. 2, 1: 271. 1878, hom. illeg. non *M. gracilis* (Licht. ex Roem. & Schult.) Diels, 1833. TYPE: Angola, Huila, near Lopollo River, *Welwitsch 1545* (BM, lectotype; K, LISU, isolectotypes).

Plants small, often growing in clumps, 15–30(–35) cm high. *Corm* 1–1.5 cm in diameter; tunics of fine, grey brown reticulate fibers. *Prophylls* short, membranous to herbaceous, usually entire at the apices. *Leaf* solitary, inserted midway up the stem, usually 5–12(–20) cm long, rarely exceeding the inflorescence. *Stem* simple with an extended lower internode. *Bract leaf* 1, herbaceous, 3–4 cm long, above the leaf. *Spathes* herbaceous with dry upper margins; inner spathe 4.5–6(–7) cm long, the outer ca. ⅔ the inner. *Flowers* yellow; *outer tepals* 2–3(–3.5) cm long, the limb 1–2 cm long, spreading; *inner tepals* 1.3–2.0 cm long, (probably) erect. *Filaments* 5–6 mm long, united in the lower half; *anthers* 4–5 mm long. *Ovary* 5–8 mm long; style branches ca. 1 cm long, the crests to 1.0 cm long. *Capsule* ovoid-globose, 7–10 mm long; *seeds* small, angular to somewhat flattened. Chromosome number not known.

Flowering time: October to January (March).

Distribution: Angola and Zambia, in moist situations.—FIG. 15.

Moraea clavata was among the first species of *Moraea* known from tropical Africa, having been collected in the 1850s by Welwitsch during his exploration of Angola. It was first named *M. gracilis* by Baker (in 1878) but this, a homonym, was replaced with *M. clavata* by Foster in 1936. Only a few collections are known, mainly from the southwestern highlands of Angola, but there are also records from western and northern Zambia, in the Mwinilunga and Serenje districts, the former some 800 km and the latter 1,500 km to the east of the Angola populations. It is a moisture loving species, found only in marshy places, dambos, etc. and has a very long flowering period, from late spring in October to January, with one record in March.

It is a distinctive species, one of the smallest in subgenus *Grandiflora*, with a rather short leaf inserted well above ground level, a single bract, and a very small flower with an ovary 6–8 mm long. It is clearly related to *M. brevifolia*, a taller and larger-flowered species which grows in a similar habitat in western and northern Zambia. The difference in size between these two alone makes confusion unlikely.

ANGOLA. HUILA: Serra de Chela, Humpata, *Gossweiler 13315* (LISC). Humpata Plateau near Nhime, *Santos 76* (LISC). Huila, *Antunes s.n.* (LISU). Near the Lopollo River, *Welwitsch 1545* (BM, COI, K, LISU). Without precise locality, *Antunes 643* (LISC).

ZAMBIA. CENTRAL REGION: Serenje, *Fanshawe 6731* (K, SRGH). Road between Mpika and Kapiri-Mposhi, Serenje district, *Richards 16869* (K). WESTERN REGION: Mwinilunga district, dambo NE of Dobega Bridge, *Milne-Redhead 3620* (K).

21. **Moraea upembana** Goldbl., sp. nov. TYPE: Zaïre, Shaba, Parc Nationale de l'Upemba, banks of Lumana River, *de Witte 2400* (BR, holotype).—FIG. 16.

Planta parva, 10–20 cm alta. *Tunicae* cormi tenues, reticulatae. *Folium* ignotum, absens tempore florenti. *Caulis* simplex ferens 1–2 bracteis. *Spathae* herbaceae, interior 3.5–7 cm longa, exterior 3–4 cm longa. *Flores* luteis; *tepala exteriora* 2.7–4.5 cm longa, limbis 1.5–2.5 cm longis, expansis; *interiora* 2–2.5 cm longa. *Filamenta* ad 7 mm longa; *antherae* ad 8 mm longas. *Germen* 8–15 mm longum; rami styli ca. 10 mm longi; cristae ad 7 mm longas.

Plants small, 10–20 cm high, unbranched. *Corm* ca. 1 cm in diameter; tunics of pale to dark, finely reticulate fibers extending upward in a neck. *Prophylls* dry-membranous, entire or irregularly broken. *Leaf* unknown, absent at flowering time. *Stem* bearing 1 or 2 herbaceous bract leaves. *Spathes* herbaceous, with dry, pale brown acute apices; inner spathe 3.5–7 cm long, the outer 3–4 cm long, ca. half the length of the inner. *Flowers* yellow; *outer tepals* 2.7–4.5 cm long, the limb 1.5–2.5 cm long, spreading; *inner tepals* probably erect, 2–2.5 cm long. *Filaments* to 7 mm long; *anthers* to 8 mm long. *Ovary* 8–15 mm long; style branches ca. 10 mm long, the crests to 7 mm long. *Capsule* and *seeds* unknown. Chromosome numbers not known.

Flowering time: July.

Distribution: Zaïre, Shaba, apparently very local.—FIG. 17.

Known only from the type collection, this rare plant was placed by Geerinck (1970) in his treatment of *Moraea* in Zaïre and Burundi in *M. textilis*, according to his very wide interpretation of this species. It has however a number of very unusual features which make it appear to me quite distinct and perhaps not even very closely allied to *M. textilis*. Firstly, *M. upembana* flowers in July, in the dry season, is relatively short, standing up to 20 cm high, and is apparently quite leafless at this time. In contrast, *M. ventricosa* and *M. macrantha* (also included by Geerinck in *M. textilis*) normally flower in March and April in Shaba at the end of the wet season, and even those plants collected as late as May and June are as tall and as large flowered as the collections from earlier in the season, and do have a well-developed, green leaf. In other morphological features *M. upembana* also seems distinct, for it has very fine corm tunics, only 1 or 2 short

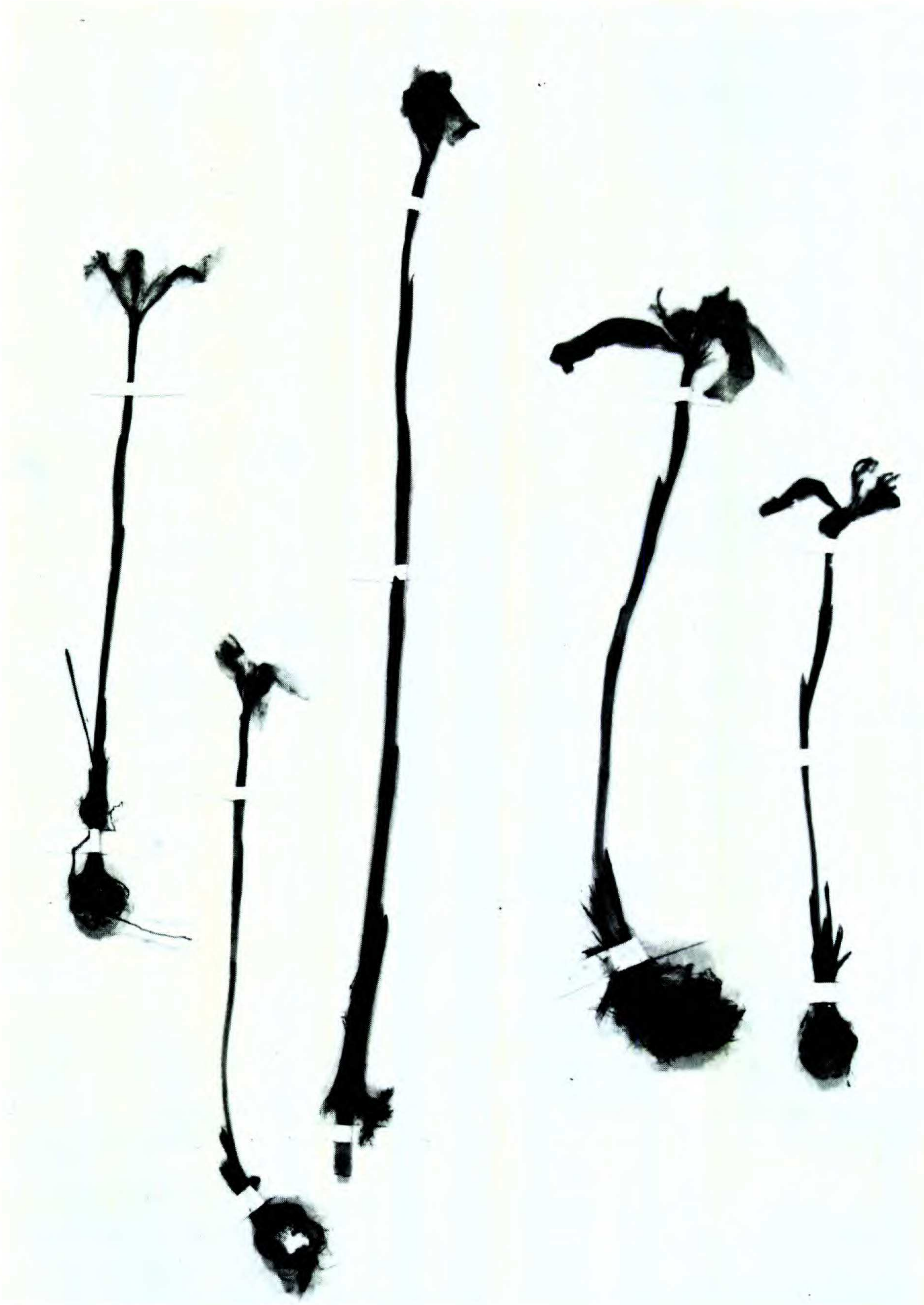

FIGURE 16. Type collection of *Moraea upembana*.

bract leaves, and is much smaller in all characteristics than *M. ventricosa* or *M. macrantha*, both of which have coarser corm tunics and 3–5 large bract leaves.

Though the single collection known is inadequate for a complete understanding of *M. upembana*, it seems best associated with the group of morphologically

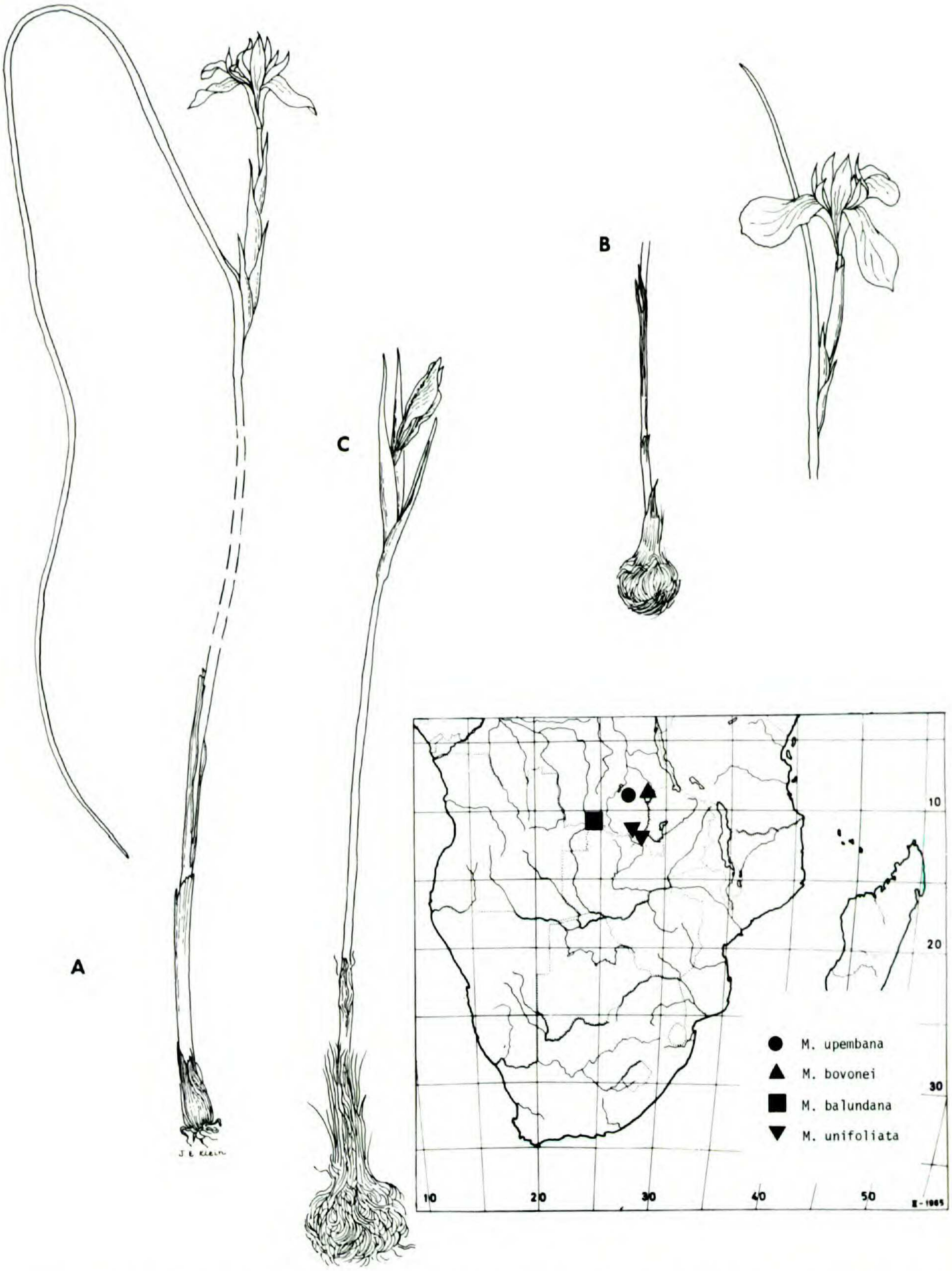

FIGURE 17. Distribution of *Moraea upembana*, *M. bovonei*, *M. balundana*, and *M. unifoliata* with morphology of—A. *M. bovonei*.—B. *M. balundana*.—C. *M. unifoliata* (×0.5).

reduced species of subgenus *Grandiflora*, and seems most closely related to the Angolan *M. clavata* and its relative *M. brevifolia* from Zambia. Further collections are needed to resolve the remaining questions about this species, including its habitat, variation pattern, and even the details of its leaf and flower structure.

ZAÏRE. SHABA: Parc Nationale de l'Upemba, Lumana River, *de Witte 2400* (BR).

22. **Moraea bovonei** Chiov., Nuovo Giorn. Bot. Ital. 26: 72. 1919. TYPE: Zaïre, Shaba, Ditungula, Lake Mweru, *Bovone 12* [F, lectotype; T (photograph seen) isolectotype].—FIG. 17A.

Plants slender, to 40 cm tall, with the leaf extending a further 40 cm. *Corm* and tunics not known. *Prophylls* papery, pale, becoming torn and irregular at the apices. *Leaf* terete, ca. 40 cm long, inserted at the base of the inflorescence. *Stem* with a long lower internode at the apex of which are 2 herbaceous bract leaves, each ca. 3.5 cm long, and the inflorescence. *Spathes* herbaceous with dry attenuate apices; inner spathe ca. 6 cm long, the outer slightly shorter. *Flower* yellow; *outer tepals* to 2.6 cm long; *inner tepals* to 2.4 cm long. *Filaments* ca. 8 mm long, united in the lower half; *anthers* 7 mm long. *Ovary* 8–10 mm long; style branches 1.2 cm long, the crests to 7 mm long. *Capsule* and *seeds* unknown. Chromosome number unknown.

Flowering time: Summer (February).

Distribution: Zaïre, eastern Shaba, marshes of Lake Mweru.—FIG. 17.

Moraea bovonei, known from only a single gathering, is a most unusual species. It has a very long slender stem, some 40 cm high, and the long leaf is inserted at the stem apex, immediately under the inflorescence. Unlike the related species, *M. balundana* and *M. unifoliata*, in which the leaf is also inserted below the inflorescence, the leaf of *M. bovonei* is very long, approximately equal in length to the stem. *Moraea bovonei* can be distinguished from its allies not only by its long stem and leaf but also by the presence of two bract leaves at the base of the spathes, whereas there is only one in *M. balundana* and none in *M. unifoliata*.

ZAÏRE. SHABA: Ditungula, Lake Mweru, *Bovone 12* (F, T).

23. **Moraea balundana** Goldbl., sp. nov. TYPE: Zaïre, Shaba, 52 km SW of Mutshatsha, *Robinson 6025* (K, holotype; M, SRGH, isotypes).—FIG. 17B.

Planta 15–40 cm alta. *Tunicae* cormi fuscae, tenues, reticulatae. *Folium* solitarium, insertum ad base inflorescentiae, 6–11 cm longum, teres. *Caulis* simplex, ferens bracteam unum. *Spatha* interior herbacea, 3–4.5 cm longa, exterior sicca, brunnea, 1.5–2 cm longa. *Flores* luteis; *tepala exteriora* 3–5 cm longa, limbis 1.7–3 cm longis, expansis; *tepala interiora* 2–3 cm longa. *Filamenta* 8–10 mm longa; *antherae* 8–9 mm longae. *Germen* ca. 8 mm longum; rami styli 1.2–1.5 cm longi; *cristae* 5–10 mm longae.

Plants slender and unbranched, 15–40 cm high. *Corm* ca. 1.5 cm in diameter; tunics of dark, finely reticulate fibers extending shortly upward in a neck. *Prophylls* membranous, but the upper one dry and becoming fibrous. *Leaf* 6–11 cm long, terete, inserted at the base of the inflorescence, and shortly exceeding it. *Stem* slender with a very long lowermost internode. *Bract leaf* 1, short, brown. *Spathes* unequal; inner spathe 3–4.5 cm long, herbaceous below, dry-brown at the apex, the outer 1.5–2 cm long, entirely brown, less than half the inner. *Flower* yellow; *outer tepals* 3–5 cm long, the limb 1.7–3 cm long, spreading; *inner tepals* 2–3 cm long, evidently erect. *Filaments* 8–10 mm long, free in the upper half; *anthers* 8–9 mm long. *Ovary* ca. 8 mm long; style branches

1.2–1.5 cm long, the crests 5–10 mm long. *Capsule* and *seeds* unknown. Chromosome number not known.

Flowering time: December.

Distribution: Zaïre, southwestern Shaba (Katanga) in permanently wet dambo.—FIG. 17.

Moraea balundana, known only from a single gathering in the southern part of Zaïre, close to the Angola and Zambia borders, is named after the Balunda tribe who live in this area. The species is closely related to *M. bovonei* which occurs to the east near Lake Mweru. *Moraea balundana* differs from *M. bovonei* mainly in its shorter leaf, single, dry, dark brown bract leaf, and unusually short, brown outer spathe. Further collections are needed to assess the variation in the species, and thus to better understand its relationship to the very similar *M. bovonei* and to *M. unifoliata*, also closely related. However, in the absence of more material, the unusual features of leaf, bracts, and spathes necessitate specific recognition. The species was assigned to *M. angusta* (Thunb.) Ker by Geerinck (1972), but the resemblance to this South African plant from the Cape region is only superficial. There seems no doubt that there is no close relationship between the two, assigned by Goldblatt (1976a, 1976b) to different subgenera of *Moraea*.

ZAÏRE. SHABA, 52 km SW of Mutshatsha, near Zambian border, *Robinson 6025* (K, M, SRGH).

24. **Moraea unifoliata** Foster, Contr. Gray Herb. 114: 48. 1936. TYPE: as for *M. aphylla* De Wild.—FIG. 17C.

M. aphylla De Wild., Ann. Mus. Congo, Sér. 4, Bot. 2: 21. 1913, hom. illeg. non *M. aphylla* L.f., 1781. TYPE: Zaïre, Shaba (Katanga), Tembwe, *Hock s.n.* (BR, holotype).

Plants 20–35 cm high, unbranched. *Corm* ca. 1.5 cm wide; tunics of pale medium-fine reticulate fibers extending up in a neck. *Prophylls* papery, light brown, often fibrous above. *Produced leaf* of flowering individuals 4–6.5 cm long, seldom longer than the spathes, inserted near the apex of the stem and usually partly sheathing the inflorescence. *Stem* simple and lacking bract leaves. *Spathes* 4–6 cm long, herbaceous, or becoming dry, attenuate; inner spathe equal to or shortly exceeding the outer. *Flowers* yellow; *outer tepals* lanceolate, ca. 3.5 cm long, the claw to 1.5 cm long, spreading; *inner tepals* 2.5–3 cm long, erect. *Filaments* ca. 7.5 mm long, free in the upper part (half to a quarter); *anthers* 7.5–9 mm long. *Ovary* 7–10 mm long; style branches to 1.5 cm long, the crests 5–9 mm long. *Capsule* ovoid-globose, to 1 cm long, *seeds* not known. Chromosome number not known.

Flowering time: Late November to January.

Distribution: Zaïre, southern Shaba in moist situations along dambo margins or sponges.—FIG. 17.

Moraea unifoliata can immediately be recognized by its apparent lack of a produced leaf. It does, however, have a leaf which is inserted at the base of the inflorescence, but it is very short, and seldom extends more than 6 cm, thus not exceeding the inflorescence spathes. It is also distinctive in lacking bract leaves, a feature which separates it from its close allies, *M. bovonei* and *M. balundana* in both of which the leaf is also inserted at the base of the spathes. The slender *M. bovonei*, however, has a very long leaf and two small bracts, while *M. balundana* has a shorter leaf and a single short, brown bract. These three species all grow in similar situations, moist sponges or along the margins of marshes or dambos, and bloom in summer. *Moraea unifoliata* is a fairly local species recorded from several sites, all in southern Shaba near Lumumbashi.

The singular habit of *M. unifoliata*, with its very short produced leaf placed immediately below the inflorescence and its complete lack of bracts, make the species appear one of the most specialized species of subgenus *Grandiflora*. It appears as the end product of a series of reduced species which begins with *M. tanzania* and *M. brevifolia*, and leads with progressive reduction in leaf size and bract leaf number through *M. clavata*, *M. balundana* and *M. bovonei*.

ZAÏRE. SHABA (Katanga): Mukuen, *Detilleux 175* (BR, WAG). Mukuen Est., *Schmitz 4250* (BR). Matuitui River, 10 km SSE of Lubumbashi (Elisabethville), *Schmitz 2371* (BR). Kapeluka, 16 km NE of Lubumbashi, *Schmitz 4766* (BR, WAG). Kipopo, 25 km NE of Lubumbashi, *Schmitz 8118* (BR, WAG). Marie-José, *Quarré 1478* (BR, GH).

INCOMPLETELY UNDERSTOOD SPECIES

The following taxon, represented by two collections, is problematic and may represent an undescribed species or a variant of a known one. Material is inadequate at present to provide a satisfactory solution.

Moraea *sp. 1*

Two collections only, of a very tall, large yellow-flowered species were made in the region of Lake Tanganyika. One, *Robyns 2192* was collected in Zaïre, between Pweto and Baudoinville, the other, *Wallace 1302*, was found in Tanzania. The plants are about 1 m tall and have large flowers which suggests that they may be forms of *M. verdickii*. They are, however, late flowering, in May, and have between 4 and 7 large bracts which in the Wallace collection are closely imbricate. Typically, *M. verdickii* blooms from December to February and rarely has more than three bracts, which do not overlap. The Robyns collection resembles to some extent *M. bella*, though it is unusually robust for this species and does not seem to fit in *M. bella* as presently circumscribed. Further material from this area is needed before a decision can be reached concerning these specimens.

EXCLUDED SPECIES

1. **Moraea revoluta** Wright

This species is excluded as the type material is teratological. The specimen, said to have been grown at Kew from corms collected in Angola, clearly belongs to subgenus *Grandiflora*, and the flowers resemble the pale form of *M. textilis*. Unique for the subgenus, however, are the several, linear, produced leaves. No other species or specimen of subgenus *Grandiflora* has more than a single leaf and the presence of more is almost certainly abnormal.

2. Several species of *Moraea*, described from Angola and Rhodesia, are now recognized as belonging to the genus *Ferraria*. Some have been transferred to *Ferraria* while others remain in *Moraea*. In spite of the multiplicity of names, there is probably only one species of *Ferraria* in the whole area including Angola, Zambia, Zaïre, and Rhodesia. The most commonly accepted name for the species is *F. glutinosa* (Baker) Rendle and the many synonyms originally placed in *Moraea* are listed below. *Ferraria glutinosa* is distinguished from *Moraea* by several features, the most readily observable being the equitant leaf, while the branched axis with sticky exudate below the internode are features lacking in the tropical African species of *Moraea*. It is further distinguished from *Moraea* by its long-lived, tuberlike corms which apparently lack tunics.

Ferraria glutinosa (Baker) Rendle, Cat. Afr. Pl. Welw. 2: 27. 1899.

Moraea glutinosa Baker, Trans. Linn. Soc. London, Bot., Ser. 2, 1: 271. 1878. TYPE: Angola, Huila, near Lopollo River, *Welwitsch 1543* (BM, holotype; LISU, isotype).

M. candelabrum Baker, Trans. Linn. Soc. London, Bot., Ser. 2, 1: 271. 1878. TYPE: Angola, Huila, Morro de Lopollo, *Welwitsch 1544* (BM, holotype; LISU, isotype).

M. andongensis Baker, Trans. Linn. Soc. London, Bot., Ser. 2, 1: 271. 1878. TYPE: Angola, Pungo Andongo, *Welwitsch 1532* (BM, holotype; LISU, isotype).

M. spithamaea Baker, Trans. Linn. Soc. London, Bot., Ser. 2, 1: 271. 1878. TYPE: Angola, Huila, plains around Humpata and Lopollo, *Welwitsch 1547* (BM, holotype; LISU, isotype).

M. aurantiaca Baker, Fl. Trop. Afr. 7 (addendum): 575. 1898. TYPE: Angola, Malange, *Mechow 303* (B, holotype).

M. kitambensis Baker, Fl. Trop. Afr. 7 (addendum): 575. 1898. TYPE: Angola, Bangala, swamps at Kuango, *Buchner 679* (B, holotype).

M. randii Rendle, J. Bot. 36: 144. 1898. TYPE: Rhodesia, Bulawayo, *Rand s.n.* (BM, holotype).

Ferraria candelabrum (Baker) Rendle, Cat. Afr. Pl. Welw. 2: 27. 1899.

F. andongensis (Baker) Rendle, Cat. Afr. Pl. Welw. 2: 27. 1899.

Moraea malangensis Baker, Bull. Herb. Boissier, sér. 2, 1: 862. 1901. TYPE: Angola, Malange, *Mechow 386* (not seen).

(Other synonyms include *Ferraria welwitschii* Baker and *F. hirschbergii* Bolus.)

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